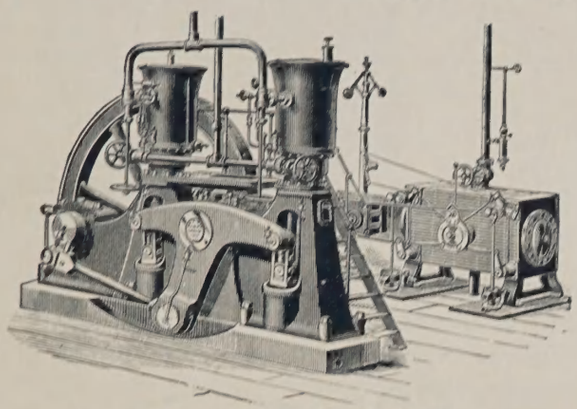
Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

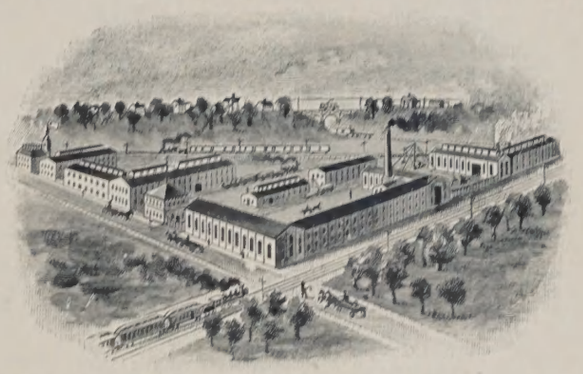
(REFRIGERANT: ANHYDROUS AMMONIA.)



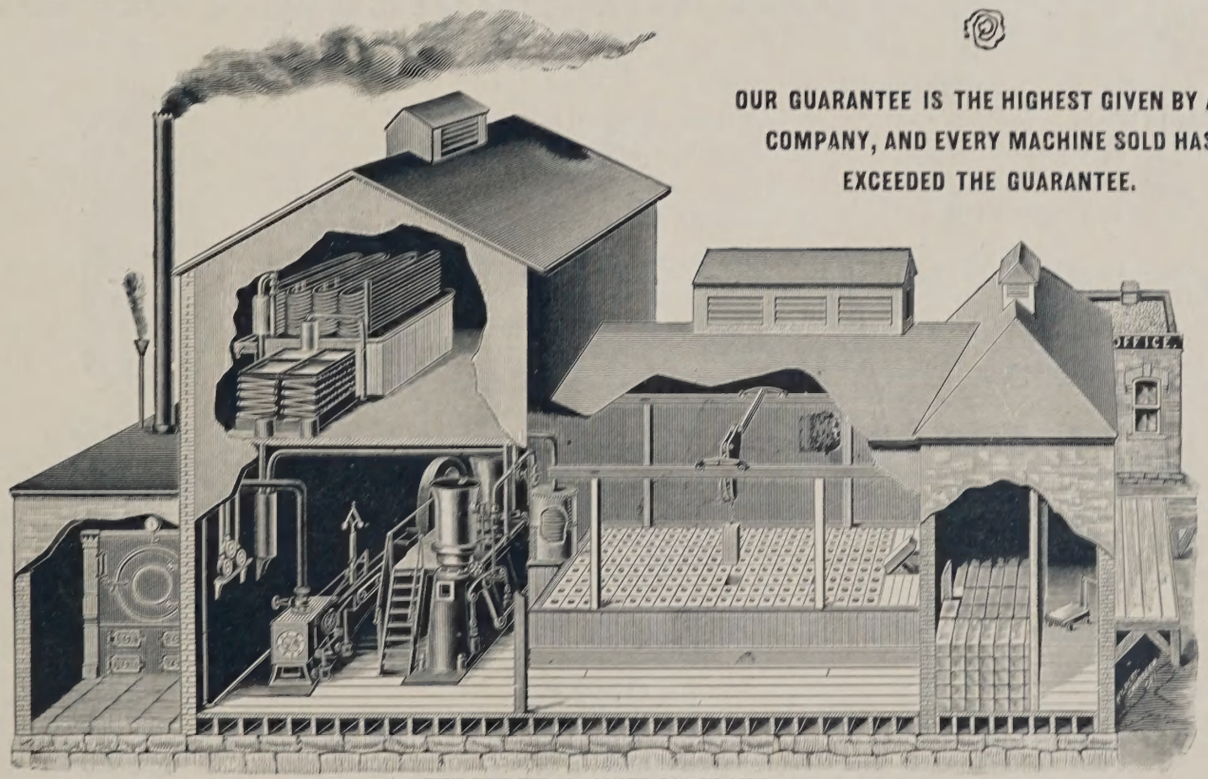
THE HERCULES ICE MACHINE.

The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.



THE HERCULES MODEL ICE PLANT.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.

SALISBURY ICE MANUF'G CO.

SALISBURY, MD.

HERCULES IRON WORKS: October 2, 1891.

Our plant which you erected for us last year can, we think, show as good record, if not better, than any machine of another make. Our plant was put in for 12½ tons, but this season our orders were so pressing that from the 23d of June to the 2d of September we drew an average of 14¼ tons daily, while our consumption of coal during that period was but 2½ tons daily of 24 hours. The ice, too, was firm and solid.

Yours truly, J. S. ADAMS, Sec'y.

ARTESIAN ICE COMPANY,

FORT WORTH, TEXAS.

HERCULES IRON WORKS: October 21, 1891.

DEAR SIRS: After three years of continuous service, the 20-ton ice machine you built for us seems in every particular just as good as new. There seems no perceptible wear of the machine as yet; the repairs amount to no more than could be expected on any first-class steam engine. The machine has fully come up to your guarantee, and even more. We have made as high as 24 tons per day of the finest ice that has ever been turned out in this city. We also find it very economical in the use of ammonia; in fact, it has fulfilled our expectations in every way.

W. B. WHEELER, Gen'l Manager. ARTESIAN ICE CO.

THE HERCULES BLUE BOOK No. 1, ON ICE MAKING AND REFRIGERATION, IS JUST ISSUED AND WILL BE SENT FREE TO INTENDING PURCHASERS.

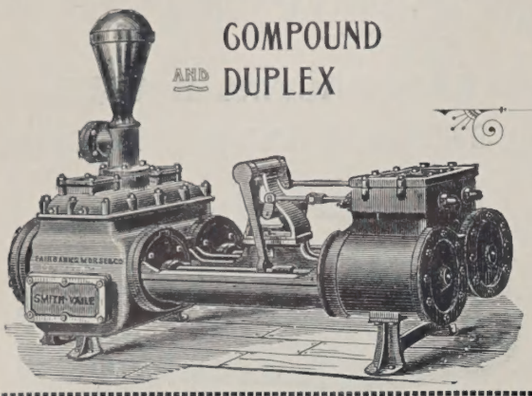
THE HERCULES IRON WORKS,

NEW YORK OFFICE, 150 BROADWAY.

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.

WORKS, AURORA, ILL.

THE SMITH & VAILE CO. DAYTON, OHIO.



COMPOUND AND DUPLEX

STEAM PUMPS

FOR EVERY PURPOSE.

WE MAKE A SPECIALTY OF

BRINE PUMPS,
COLD WATER PUMPS,
BOILER FEED PUMPS.

FOR

Ice and Refrigerating Machines.

Get our Special Prices before buying elsewhere.

NEW YORK HOUSE, 112 LIBERTY ST.

THE GORDON STEAM PUMP CO.

: BUILDERS OF :

Steam Pumping Machinery

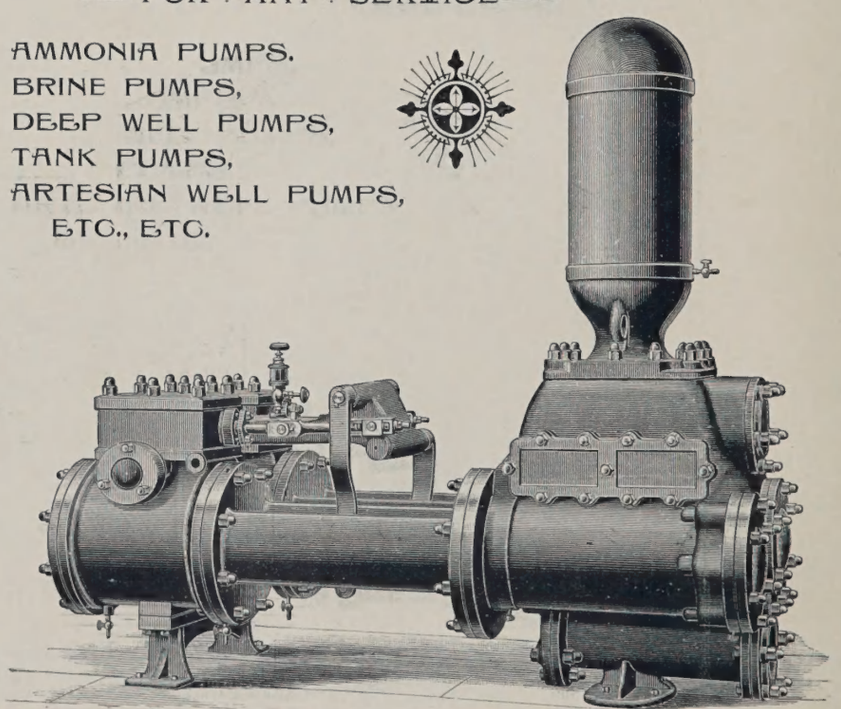
FOR ANY SERVICE

Pumps

ESPECIALLY ADAPTED FOR USE IN CONNECTION WITH

Refrigerating Machinery

AMMONIA PUMPS.
BRINE PUMPS,
DEEP WELL PUMPS,
TANK PUMPS,
ARTESIAN WELL PUMPS,
ETC., ETC.



MAIN OFFICE AND WORKS

HAMILTON, OHIO.

BRANCH OFFICES

NEW YORK—136 Liberty St.
PHILADELPHIA—705 Arch St.
PITTSBURGH—410 Lewis Block.
CHICAGO—Phœnix Building.
ST. LOUIS—703 Market St.
CLEVELAND—146 Water St.

Correspondence Solicited.



THE CHEF.

McGray Refrigerator and Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS OF ALL KINDS OF

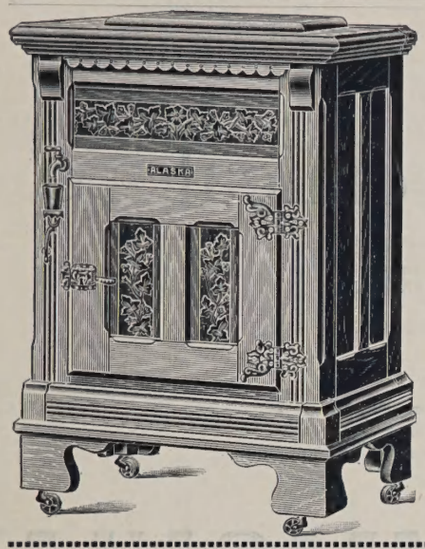
REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,

Loomis Building, Clark and South Water Streets.



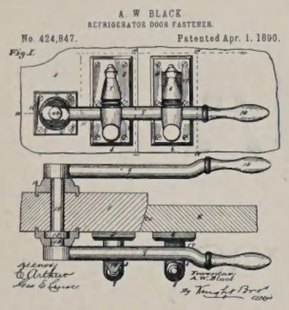
THE ALASKA REFRIGERATOR CO.

MUSKEGON, MICH.

WRITE FOR CATALOGUE AND PRICE LIST.
SPECIAL REFRIGERATORS MADE TO ORDER.

BLACK'S

LATEST IMPROVED . . .



Refrigerator Door Fastener

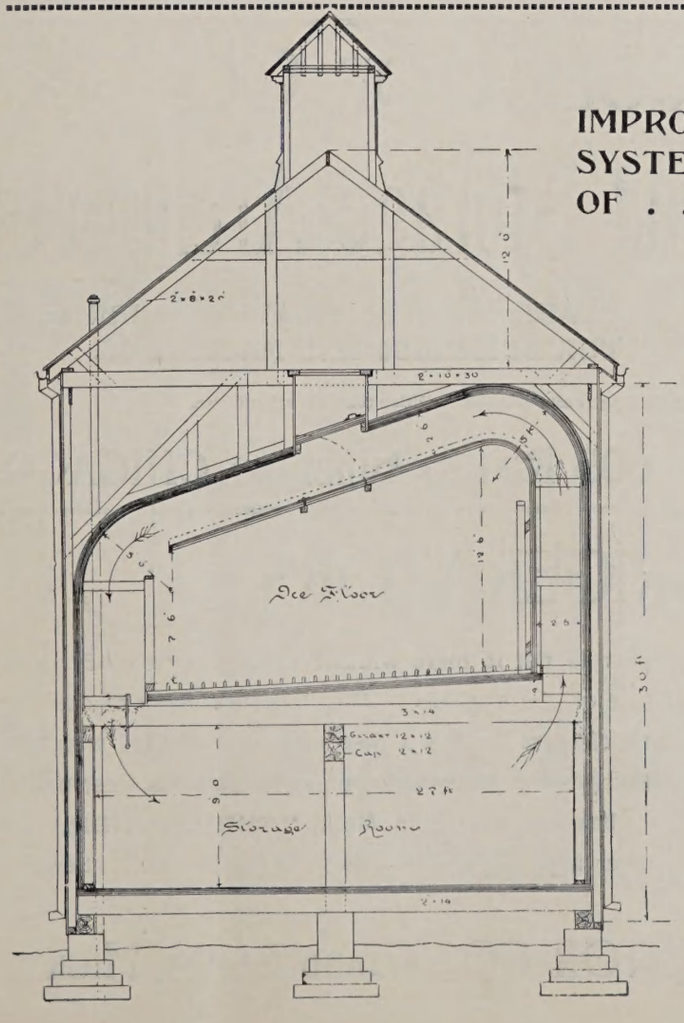
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
SENT BY EXPRESS ON RECEIPT OF $12.

A. W. BLACK, ST. LOUIS, MO.



BLACK'S

IMPROVED SYSTEM OF . . . . **Cold Storage**

.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, ST. LOUIS, MO.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

The JACKSON REFRIGERATOR Co.

EXPERTS IN

ICE AND MECHANICAL REFRIGERATION.

Cold Storage Architects

Over 300 Jackson Houses, Cooled by Ice, in Successful Operation.

PLANS AND SPECIFICATIONS FURNISHED FOR BUILDINGS AND MACHINERY.

They never become musty, and carry perishable goods longer and in better condition than any other house.

Send for "Refrigeration," a scientific treatise on Ice and Refrigeration, with Circular and Testimonials.

605 RIALTO BUILDING, CHICAGO.

ART IN REFRIGERATORS.

WHY not, as long as we have the skill and the brains to put it there without extra cost to you? Merit should always come before Art in the manufacture of these goods. We, however, have reached the second stage, and now offer you the greatest variety and choicest designs, either plain or combined with side-boards, china closets, kitchen cabinets, etc. We make Refrigerators for every purpose, for Families, Restaurants, Grocers, Butchers, Hotels, Apartment Houses, etc., all bearing our Trade Mark, "THE GLACIER," and having SEVEN walls to preserve the ice, and all our other improvements. "Best in the World." Send for complete catalogue.

THE NORTHERN REFRIGERATOR CO., GRAND RAPIDS, MICH.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.
NEW YORK: 121 Liberty Street.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° **AQUA AMMONIA**

Containing 29¼ per cent of Ammonia.

FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES

245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... **Anhydrous Ammonia.**

70 E. Prospect St., CLEVELAND, OHIO.

PURE CRYSTAL ICE—NO CONE.

NO CANS
NO BRINE
NO PLATES
NO DISTILLING

New methods used. **Cost Reduced.** Direct Expansion System. Rapid Freezing. Harvested in Blocks of Standard Sizes by the **Steam Ice Cutter.** Can Plants changed to this system.

ADDRESS,

LEA PUSEY.
WILMINGTON, DEL.

ROSENGARTEN & SONS,

PHILADELPHIA, PA.

Manufacturing Chemists

26° AQUA AMMONIA

FOR REFRIGERATING PURPOSES

MADE FROM SULPHATE OF AMMONIA ONLY.

WM. B. SEVERN. A. L. CAVEN.

SEVERN & CAVEN,

MANUFACTURERS OF

ABSOLUTELY PURE . . . . . **Liquid Anhydrous Ammonia**

MANUFACTURED FROM SULPHATE OF AMMONIA ONLY.

WORKS: WHITE HILL, N. J.

OFFICE: 48 N. Delaware Ave., PHILADELPHIA.

THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

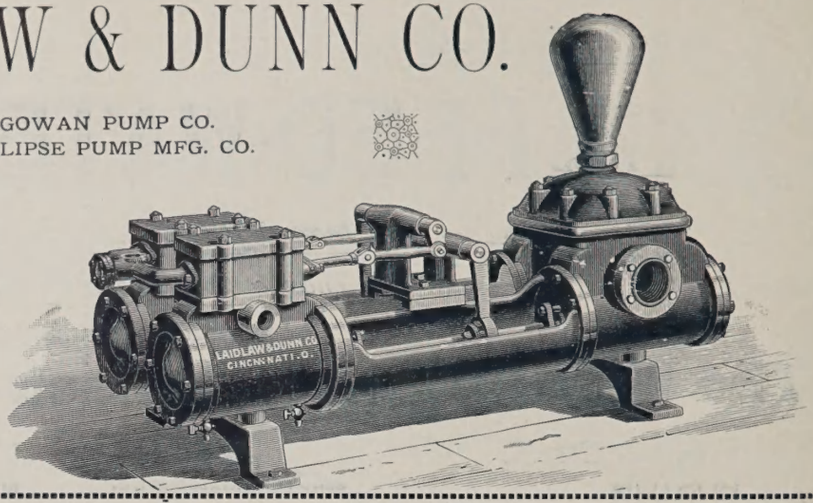
MANUFACTURERS OF

BRINE
WATER
BREWERY

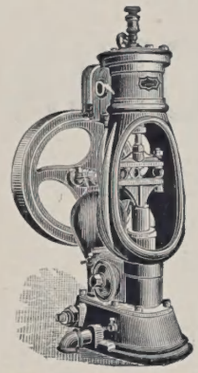
PUMPS

AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . . **PUMPS**



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

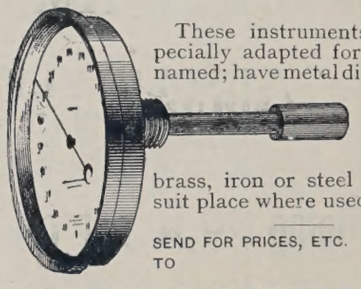
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



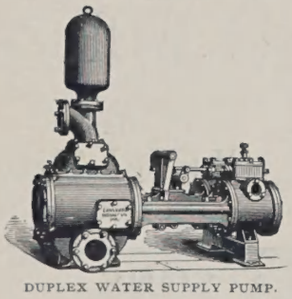
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



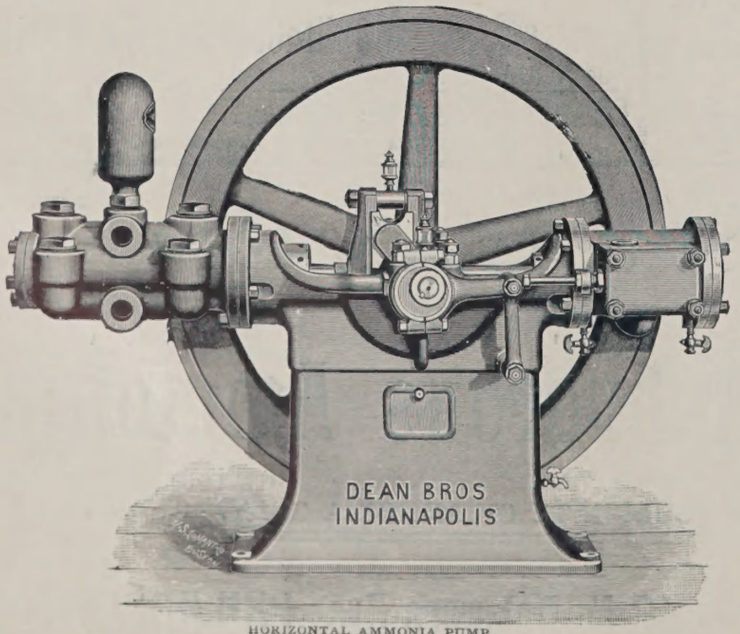
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

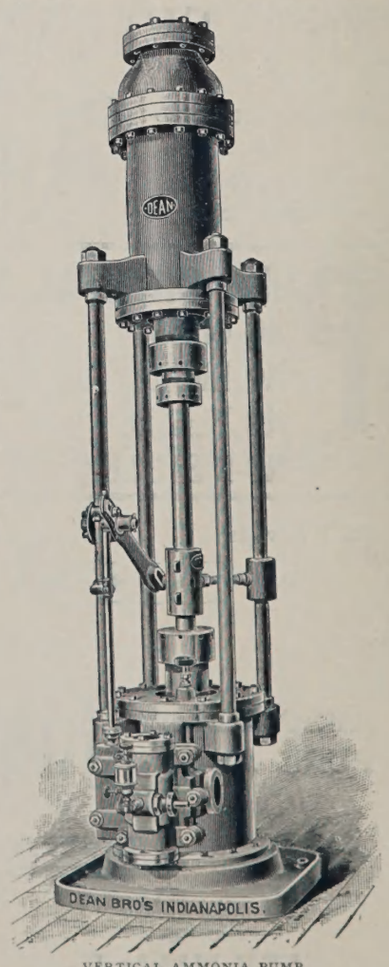
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

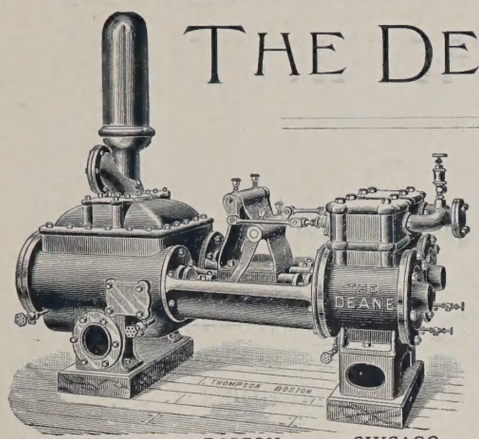
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

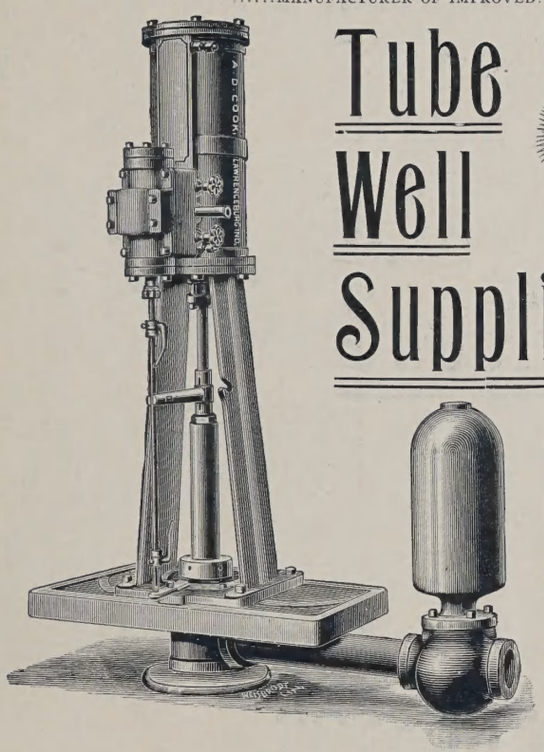
For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's
Patent
Tube
Well
Strainers

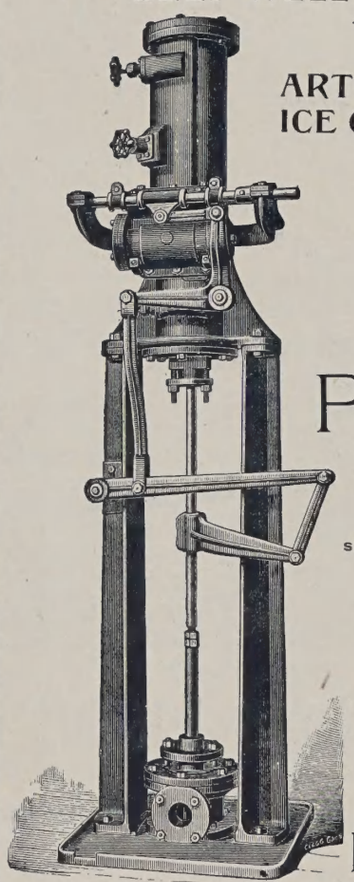
..... AND .....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

EPPING Pump

. . . DEEP-WELL



....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES

PUMPS

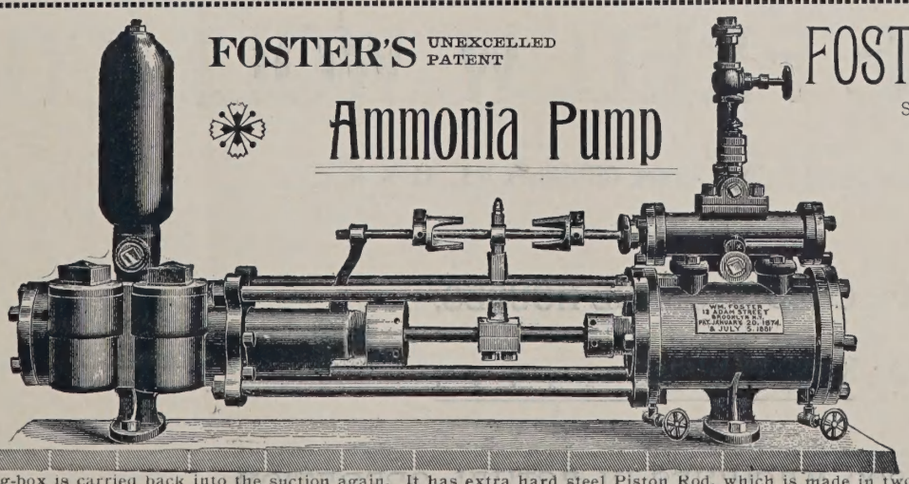
For all Purposes.

SEND FOR CATALOGUE TO

EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.



FOSTER'S UNEXCELLED PATENT

Ammonia Pump

ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuff-

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

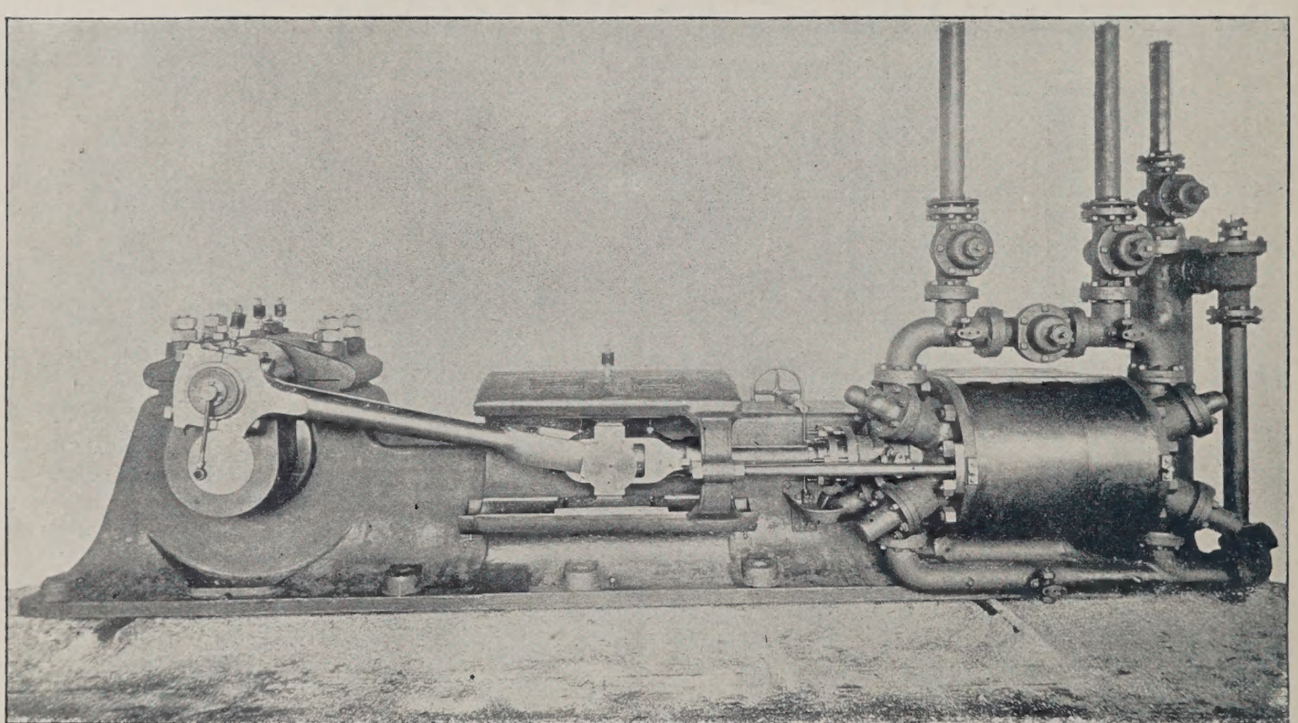
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED. . .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. II. NO. 1. CHICAGO : NEW YORK : JANUARY : 1892. $2.00 PER ANNUM.

UNCLE SAM AND REFRIGERATION.

CENTRAL BRANCH, NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS—HISTORICAL FACTS—THE COMMISSARY DEPARTMENT AND ITS REFRIGERATING PLANT ERECTED BY W. P. CALLAHAN & CO., DAYTON, OHIO.

Gen. U. S. Grant, in his incomparable "Memoirs," in a note to Chap. VII, tells us that General Winfield Scott was the father of the Soldiers' Home. It had been a favorite idea of his for many years before the war with Mexico to have such a home, patterned after the *Hotel des Invalides*, of Paris, or other European homes, and in his reports to the secretary of war he frequently recommended it, but never got a hearing. When, however, he had conquered Mexico, he made assessments on several of the larger towns, in proportion to their ability to pay, and in this way, and by the sale of captured government tobacco and stores, realized the sum of $220,000. About one-half of this sum was given to the rank and file in Mexico, to the wounded, etc., leaving $118,000 undisposed of. After that war was over, Gen. Scott applied to have this money, which had never been turned into the treasury of the United States, expended in establishing the home for soldiers which he had previously recommended. It was so applied, and the fund became the foundation of the Soldiers' Home at Washington city, and also one at Harrodsburgh, Ky., though the latter was but little used, and was sold many years ago.

The institution commonly called the "Soldiers' Home," near Dayton, Ohio, whose official name is the "Central Branch, National Home for Disabled Volunteer Soldiers," is nominally a branch of the "National Home," at Washington city, and is the outcome of the necessity for such institutions felt after the close of the civil war of thirty years ago. Seven such homes were ultimately established by the general government, in locations from Maine to California, and others have been erected by the individual states for the care of their own veterans; but of them all, not excepting that at the national capital, the Central Branch near Dayton is, perhaps, the most famous, as well as the largest, containing about 6,000 of the 13,000 or 14,000 veterans found in the seven national homes. The "home" at Camp Chase was originally founded by the state of Ohio, but in 1867 was formally transferred to the "Board of Trustees of National Homes," and the site relocated near Dayton, the grounds on which it stands containing 640 acres. At first the barracks and mess hall were of wood, and accommodated about 600 veterans, but as the years rolled round, the wooden buildings were replaced by larger permanent structures of brick and stone, and the grounds transformed and beautified by the landscape gardener into the magnificent estate whose rare beauty is indicated by the illustration above.



CENTRAL BRANCH, NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS, NEAR DAYTON, OHIO.
GENERAL VIEW, LOOKING WEST, FROM NEAR MAIN ENTRANCE.

The "home" faces east, our view having been taken approaching the entrance to the grounds, showing in the distance the noble buildings crowning the hill on which they stand. Near the main entrance is Big Lake, a lovely artificial sheet of water covering eleven acres, connected on the west with three smaller lakes. North of the lake are the postoffice and greenhouses; further west

the famous flower gardens, the conservatory and grotto; while in the distance stand (beginning at the right) the hospital, hotel, church, memorial hall, headquarters, barracks, stand pipe, etc.

In addition to barracks for the soldiers, the home has, of course, its officers' quarters, its water works, postoffice and property building; its church for religious services, and memorial hall in which theatrical and other entertainments are given; its libraries and amusement hall for games; its workshops of many kinds, a fire department, etc., as well as hotel and restaurant for transient guests, and a store for the convenience of members, the profits of which provide reading matter, amusements, etc.; its hospital for invalids and its cemetery for the dead.

The commissary, however, is, perhaps, the most interesting and important department at the home, certainly for the purposes of the present article, for it requires an enormous quantity of food to serve three meals a day to 5,000 or 6,000 men. The farm produces a large part of the vegetables consumed, but other supplies are purchased by competitive bidding. The bill of fare includes meat and potatoes twice a day, vegetables at dinner, and bread, butter and coffee or tea at all meals, with pastry and cakes daily, while on feast days, Thanksgiving, Christmas, etc., few hotels serve a more elaborate or toothsome meal. The kitchens are enormous, the cooking being done by steam, while the bake shop employs twenty-one bakers, who make 3,000 pounds of bread daily, besides innumerable pies and cakes. Some idea of the enormous quantity of food consumed may be had from the following official statement of the consumption of food at the institution:

Bread, per day, 2,550 lbs.; beef (fresh), per day 2,500 lbs.; tea, 55 lbs. per day, 600 gal.; biscuits, per meal, 615 lbs.; cheese, per day, 200 lbs.; cakes, per day, 750 lbs.; pies, per day, 2,520; beans (navy), 600 lbs.; beans (string), per day, 50 bush.; onions, 54 bush.; green peas, per day, 80 bush.; potatoes, per day, 50 bush; dried apples, per day, 375 lbs.; cucumbers, per day, 120 doz.; fresh fish, one meal every two weeks, 2,850 lbs.; cranberries, Christmas, 720 qts.; turkey, Thanksgiving, 4,438 lbs.; celery, holidays, 205 doz.; butter, per day, 550 lbs.; coffee, 260 lbs. per day, 1,300 gal.; milk, per day, 265 gal.; ham, per meal, 2,850 lbs.; sugar, per day, 550 lbs.; crackers, per day, 230 lbs.; eggs, per day, 124 doz.; beans (Lima), per day, 350 lbs.; Irish stew, one day each week, 700 gal.; onions (green), bunches, 340 doz.; beets, per day, twenty-five bush.; prunes, per day, 400 lbs.; green corn, per day, 405 doz.; squashes, per day, 158 doz.; mutton, weekly, 3,000 lbs.; oysters, Christmas, ninety-five gal.; oranges, holidays, 500 doz.; lager beer, forty bbls. daily.

Necessarily the quantity of food supplies stored at the home must be enormous, stores being laid in to last not only for a day, but for weeks and even months, and some means had to be adopted not only to store food but to refrigerate the perishable supplies. Early last spring, therefore, after the completion of the commissary building (a view of which is shown above), a building over 400 feet long, erected at a cost of $75,000, bids for a 50-ton refrigerating machine were advertised for, the specifications for which called for a machine to refrigerate the following apartments:

(1.) A beer cellar containing 15,000 cu. ft.; distance from ice machine room, 560 ft.

(2.) Kitchen storage at mess hall, containing 4,000 cu. ft.; distance from ice machine room, 625 ft.

(3.) Commissary storage, containing 15,000 cu. ft.; distance from ice machine room, 270 ft.

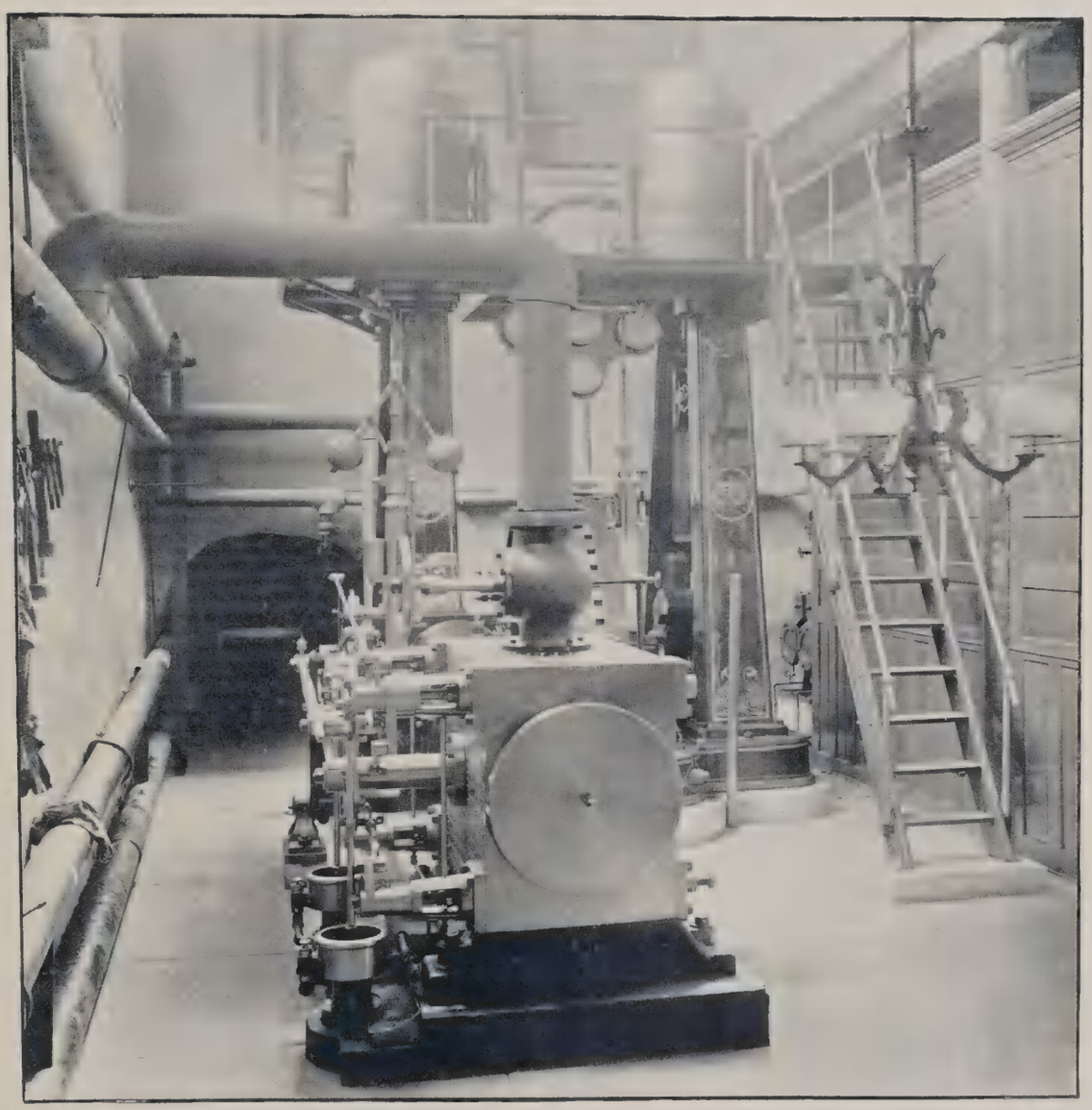
All apartments were required to have a temperature of 38° F. The machine was also required to make twelve tons of ice daily in a run of ten hours, with a steam pressure of not more than fifty pounds—all



VIEW OF COMMISSARY BUILDING, ICE TANK AND ENGINE HOUSE. FOUR COMPARTMENTS IN COMMISSARY BUILDING ARE REFRIGERATED BY W. P. CALLAHAN & CO.'S 50-TON MACHINE.

machinery to be erected in a room twenty-six feet square.

Competition was very active, as all refrigerating machine builders were anxious to construct a machine for the United States government; and five bids were presented from leading manufacturers. After due deliberation, the contract was awarded to W. P. Callahan & Co., Dayton, Ohio. It may be said here that the machine after completion was paid for in cash and is doing all the work guaranteed, and even more, during a run of seven consecutive hours, instead of ten, as specified, and, as the cuts of refrigerated rooms on pages 16 and 17 will show, in several of the cold rooms only one-half of the coils are turned on.



INTERIOR OF ENGINE ROOM, SHOWING W. P. CALLAHAN & CO.'S 50-TON REFRIGERATING MACHINE, ERECTED FOR THE U. S. GOVERNMENT.

W. P. Callahan & Co.'s machine (shown above) is a compression machine with two vertical single-acting pumps and one horizontal engine with Corliss valve gear. They are built under M. Dennedy's patents, and all of their machines in operation are giving perfect satisfaction.

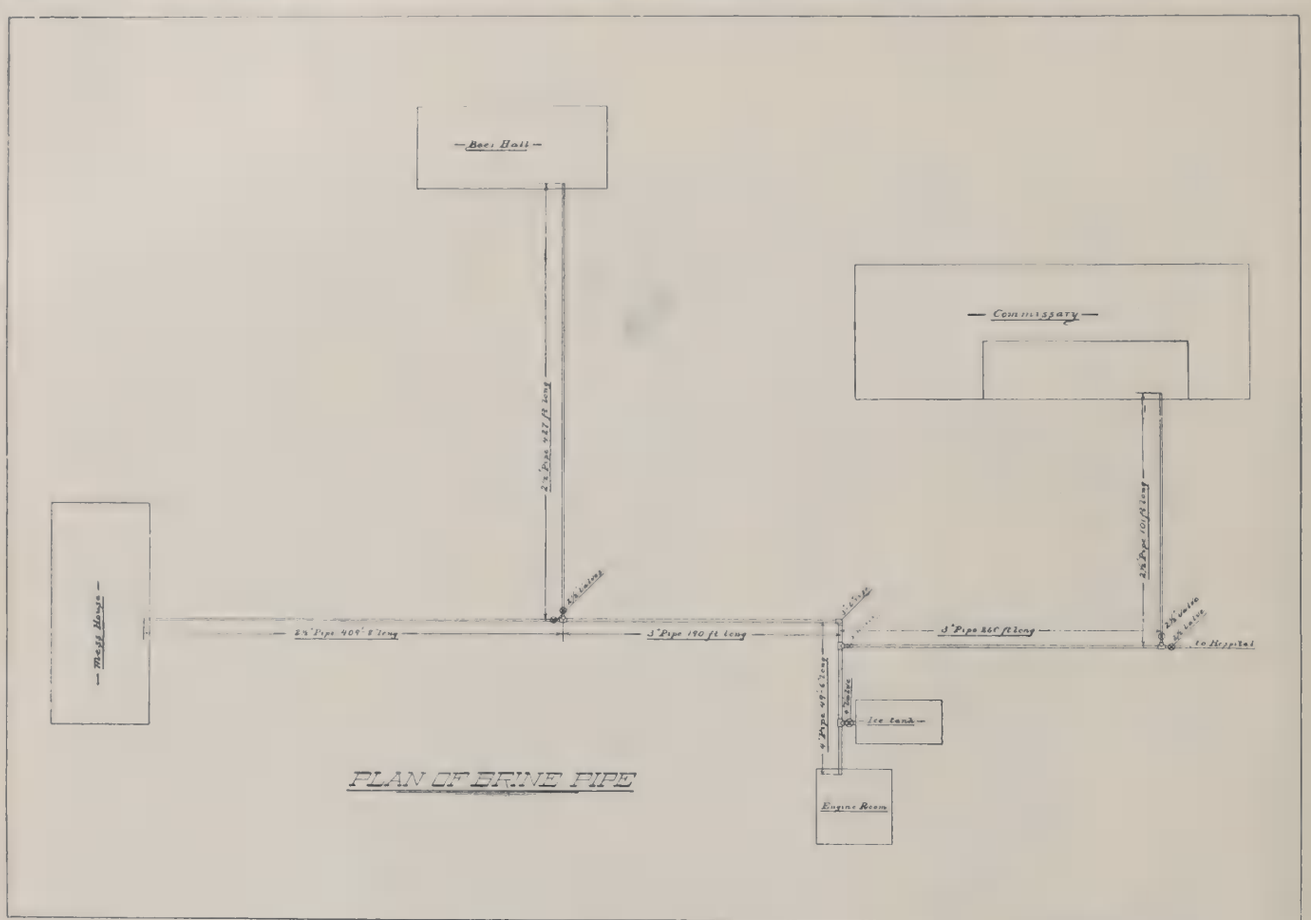
THE GENERAL PLAN OF CONSTRUCTION AND INSULATION.

The problems encountered in the installation of the plant were by no means simple. As will be seen by the diagram on page 14, the buildings or rooms refrigerated are widely separated, requiring great lengths of circulating brine pipes, and necessitating a very superior quality of insulation in order to obtain the full refrigerative value of the brine. The manner of constructing the pipe conduits is shown in the lower diagram on the same page, in connection with the diagram on page 15, showing the cork insulation. The dimensions of timbers used in the conduit walls and outer still air spaces is fully shown in the diagram, page 15, which sketch also shows the body of cork surrounding the flow and return brine pipes, with two inches of granulated cork between the 2½-inch pipes and three inches between the pipes and walls of the inner conduit. This construction, while in a measure apparently elaborate, is comparatively cheap, especially when considered in connection with its insulating value, which is very high. Granulated cork in such a conduit is particularly desirable, from the fact that it excludes moisture, and never settles into a compact body, but retains its elasticity so as to completely fill the conduit, even after long use, as perfectly as when originally laid, while its non-conductive quality is unsurpassed by any other substance of relative cost practicable for such

purpose. In this case the insulating material was furnished by B. G. Dodge, Lancaster, Pa.

THE ENGINE ROOM.

In order to make the circuit of the brine pipes, the visitor would start at the engine room, an interior view of which we give on page 13, showing the splendid ma-

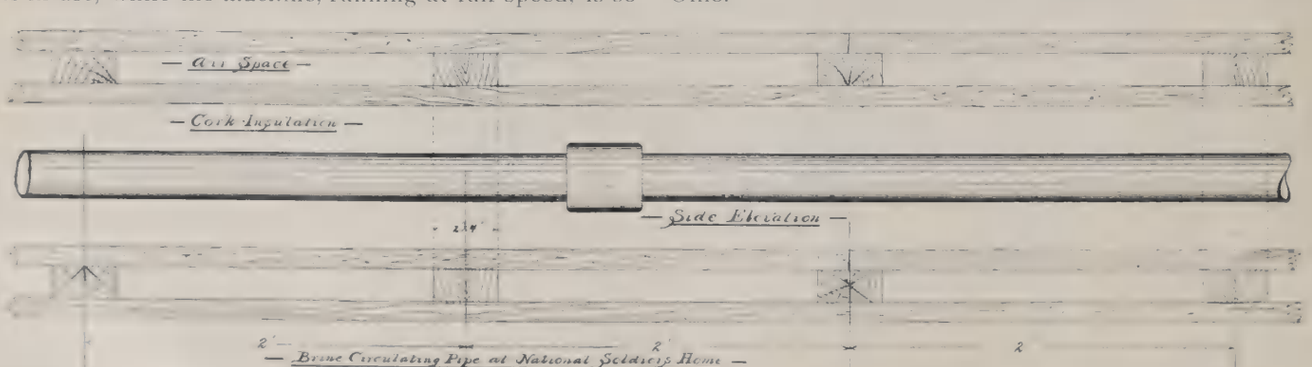


PLAN OF BRINE PIPE

chine built by Messrs. Callahan & Co. Its proportions at once impress the spectator with their beauty, while the machinist cannot fail to note the perfect workmanship displayed in every part of the construction. Every device for the guidance or convenience of the engineer is in use, while the machine, running at full speed, is so steady and free from jar that a coin will stand on edge on the steam chest without being thrown down. The machine is in charge of Thos. Evans, chief engineer, who also has charge of the entire system of steam heating, water works, gas plant, etc., and who says that the refrigerating machine is a source of less trouble and annoyance than any one other of the numerous mechanical contrivances he has to look after.

THE ICE TANK.

The ice tank adjoins the engine room, brine pipes being conducted through a cork insulated conduit, 49½ feet long, from the engine room to the tank. Ice is made in cans, twelve tons of clear, pure ice being pulled daily, the machine running from six to ten hours per day. The tank faces the street, and the ice is loaded into wagons directly from the tank for distribution through the home. The brine tanks and other sheet iron work in connection with the plant generally, were furnished by the Miami Valley Boiler Works, of Dayton, Ohio.



THE HOSPITAL.

Following the brine pipe to the commissary building, and noting the details of construction indicated in the diagram on page 14, we find the only uncompleted feature of the entire plant at the bend, where the brine pipe is closed by a two-and-one-half-inch valve, permitting an extension of the lateral pipe to the hospital, as indicated. This building stands several hundred feet to

the right, but will eventually have mechanical refrigeration wherever needed, from the present plant, the pipes being conducted thither by the same system of conduits, with cork insulation, as now in use in the completed sections of the plant.

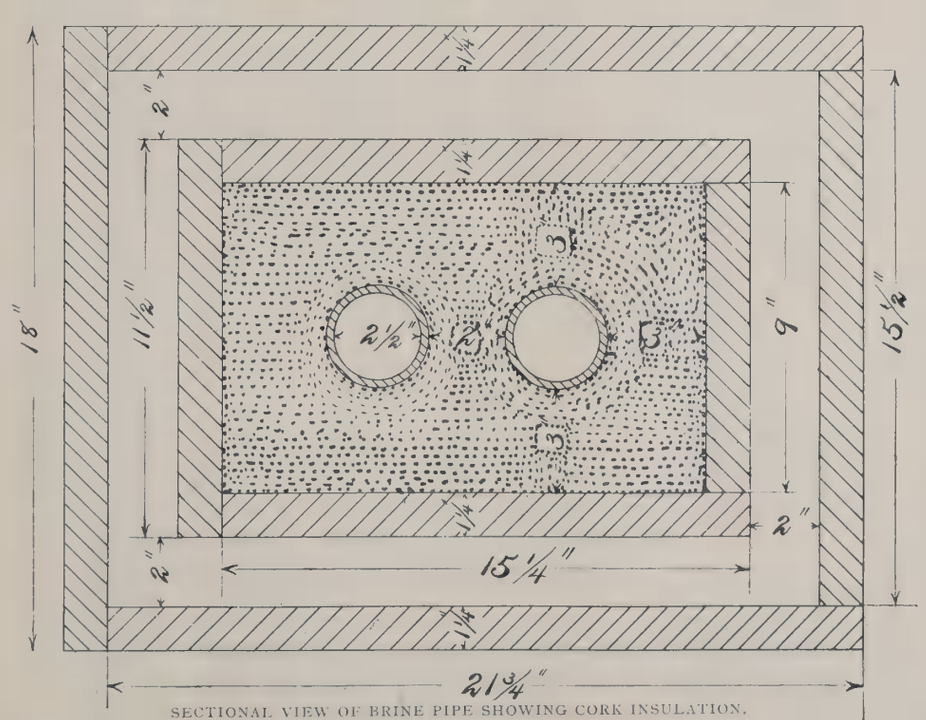
insulation is so perfect that, as will be seen by the pictures, in at least two of the rooms the full capacity of the cooling pipes is not required, yet the desired temperature is fully maintained, while the rooms themselves are perfectly dry, pure and sweet—so much so, that one



MESS HALL, NEW ADDITION ON RIGHT NOT SHOWN. CELLARS OF BOTH BUILDINGS REFRIGERATED. DISTANCE FROM MACHINE, 649 FEET.

THE COMMISSARY BUILDING AND MESS HALL.

The commissary building stands (on the pipe line) 411 feet distant from the ice machine. This beautiful structure is shown on page 12. It has four



SECTIONAL VIEW OF BRINE PIPE SHOWING CORK INSULATION.

refrigerated apartments, pictures of three of which we show on pages 16 and 17—compartments for dressed meat, for cut meats, and for milk, butter, etc. Notwithstanding the extreme distance from the tank, the

is tempted by the delicious coolness and cleanliness of the rooms, and the sight of the toothsome viands crowded into them, to sit down there and then and "fill up."

The main mess hall is shown above, though without the new addition. The cellars of both buildings are refrigerated, the distance from the machine being 649 feet. In the main building there are dining rooms in both stories, but with the new addition in use none of the veterans will be required to climb to the second story for their meals. Here, as in the commissary building, though the distance from the machine is 238 feet greater, the refrigeration is accomplished in as thoroughly satisfactory manner.

THE BEER HALL.

The beer hall is 667 feet distant from the machine, and is one of the interesting features of the home. Considering that there are about 6,000 men at the home, the consumption of the "amber liquid" is very moderate, yet it amounts to forty barrels per day. It is a new feature on the grounds, and was designed to furnish a mild liquor to the members of the home on the grounds, and remove the temptation formerly held out to them of hanging around and drinking

to excess at the innumerable low groggeries and dives outside the grounds, which used to be a disgrace to the home and to the city of Dayton itself. It is open only at certain specified times each day, and only lager beer is served over its bar. It is the exclusive privilege of the members, no civilians being allowed within its walls, nor officers of the home, except those directly concerned with its management. Individuals, of course, pay for the beer they consume, but with a special coin struck for that purpose, obtainable from the commissary, and no "treating" is permitted under any circumstances; and it is noticeable that since the introduction on the grounds of this "canteen," drunkenness by members of the home has practically disappeared.



REFRIGERATED DRESSED MEAT COMPARTMENT IN COMMISSARY BUILDING. DISTANCE FROM MACHINE, 411 FEET.

The refrigeration of the beer cellar is shown on page 17, while both cellar and bar are provided with every appliance for keeping and rapidly serving the beer in the highest degree of perfection, several brands of beer being always on draught to suit the preference of the veteran consumers.

With the very complete diagrams and the pictures which we have reproduced from photographs made expressly for this article, we think our readers will have obtained a quite comprehensive idea of the character of this fine refrigerating plant, which is, in some respects, one of the most interesting and perfect we have yet seen. Its usefulness can hardly be overestimated, while its construction generally not only develops new possibilities in refrigeration, but makes it a model brine plant where complex conditions of distribution are required.

This improvement to the commissary department, enabling it to safely store large quantities of rations of all kinds, and also for manufacturing on the grounds the great quantities of ice consumed in the hospital, the barracks, and others of the many buildings located on the estate, makes the home complete in itself—a city of considerable size and one of wonderful beauty, with its own farm and dairy with products valued at $26,000, retail store, gas and water works, workshops doing $313,590 worth of business, etc., and even its own money, for copper coins of various denominations have been struck for the sole use of the home's members, and "good" nowhere else. And notwithstanding the many years that have elapsed since the close of the civil war, the number of members is constantly increasing, as old age and the infirmities of age creep over the survivors; and it was estimated in 1884, by a committee of the lower house of congress, that the maximum number of beneficiaries of the national homes would not be reached earlier than 1895, or three years hence. The wisdom of the introduction of the ice machine and refrigerating



REFRIGERATED CUT MEAT COMPARTMENT IN COMMISSARY BUILDING. DISTANCE FROM MACHINE, 411 FEET.

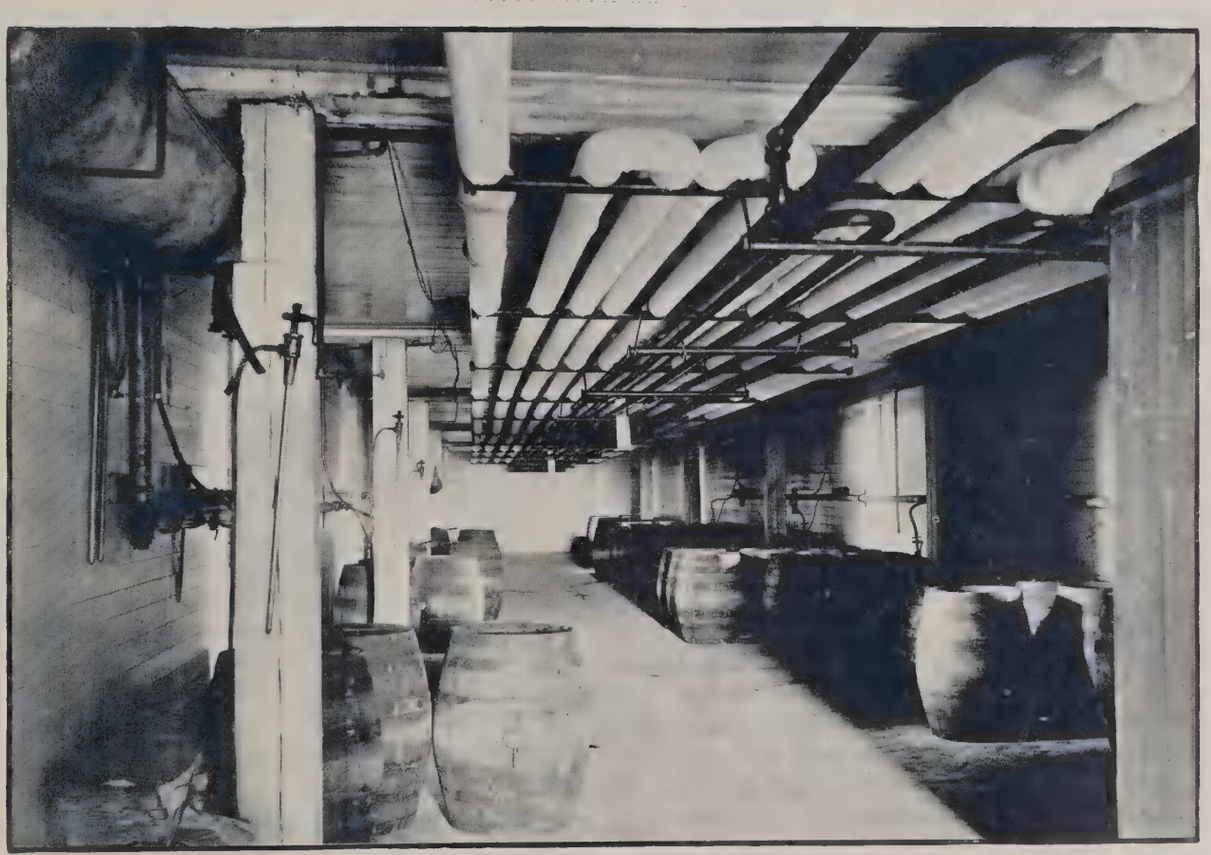
apparatus even at the late date of 1891, will, therefore, be apparent to all.

Its introduction is further evidence, also, if it were needed, of the enlightened character of the management and government of the home, which has always aimed at the highest efficiency of all executive and mechanical methods to add to the comfort of the members of the home, at the same time keeping in mind all the elements of a true economy in detail. How well the management have succeeded is attested by the fact that although the very best in subsistence that the market affords is furnished the men, the system is so perfect that the total average expense in the home for the year past, including clothing, was a little less than $121 per man, the grand total expended for subsistence having been $328,000.

The Central Home has had five governors. The first was Major E. E. Tracy, appointed in 1867. He was succeeded by General T. Ingraham, who in turn was followed by Colonel E. F. Brown, January 1, 1869. Colonel Brown remained in charge until October 1, 1880, when he was appointed Inspector-General of the National Homes for Disabled Volunteer Soldiers, being succeeded as governor by General M. R. Patrick. Governor Patrick retained this position until his death, which occurred July 27, 1888. After the death of General Patrick, Colonel Jerome B. Thomas, who had served as treasurer and second officer of the home since its inception, was appointed governor.



REFRIGERATED MILK AND BUTTER COMPARTMENT, COMMISSARY BUILDING. DISTANCE FROM MACHINE, 411 FEET.



REFRIGERATED BEER COOLER UNDER BEER HALL. DISTANCE FROM MACHINE, 667 FEET.

The other officers are as follows: The Board of Managers, consisting of fourteen members, viz.: The President of the U. S., the Chief Justice, the Secretary of War, *ex-officiis;* General William B. Franklin, President, Connecticut; General William J. Sewell, First Vice-President, New Jersey; General Martin T. McMahon, Secretary, New York City; General John C. Black, Illinois; General Francis Fessenden, Maine; Major George W. Steele, Indiana; Colonel John L. Mitchell, Wisconsin; General James Barnett, Ohio; General A. L. Pearson, Pennsylvania; Major E. N. Morrill, Kansas; Major George H. Bonebrake, California. The officers of the Central Branch, National Home, directly in charge, are: Governor, Colonel J. B. Thomas; Treasurer, Major Milton McCoy; Secretary, Major M. F. Watson; Commissary of Subsistence and Quartermaster, Captain James C. Michie; Adjutant, Major Carl Berlin; Surgeon, Dr. F. H. Patton; Chaplain, Rev. J. W. Lerch; Matron, Mrs. E. L. Miller; First Assistant Surgeon, Dr. William H. Negley; Second Assistant Surgeon, Dr. Starling Wilcox.



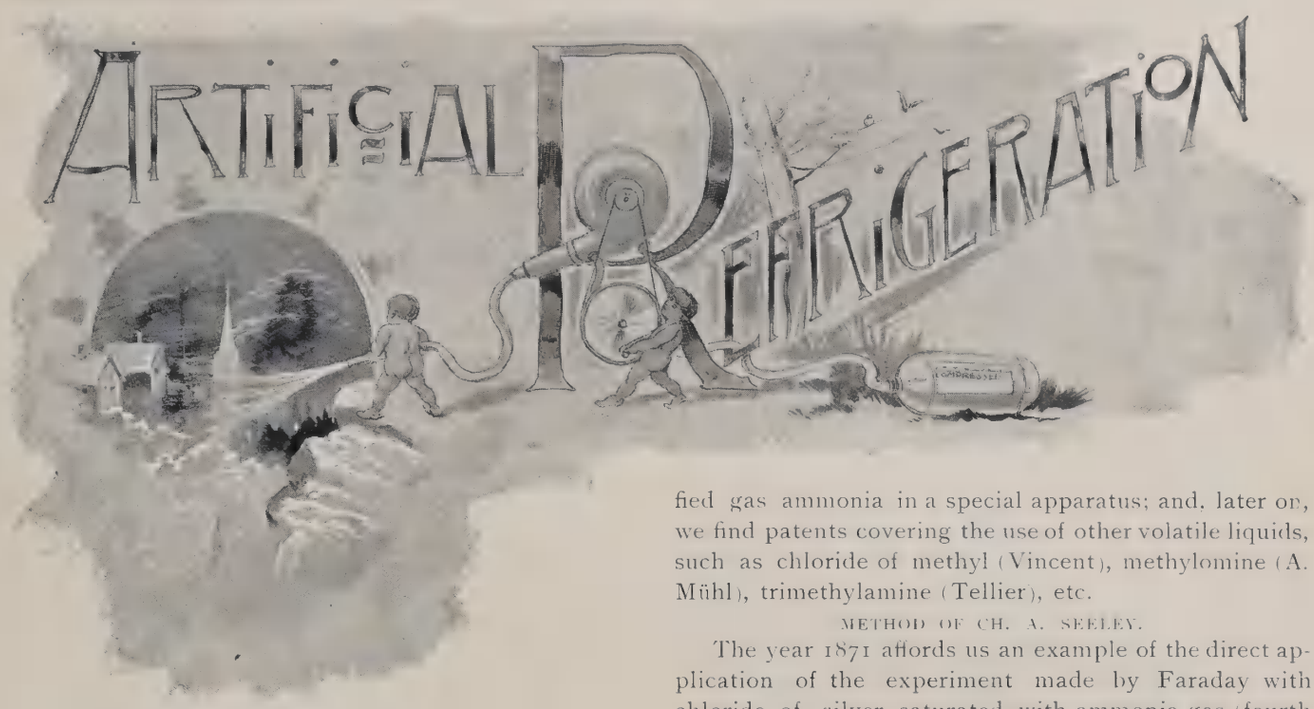
BEER HALL, NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS, DAYTON, OHIO. DISTANCE FROM MACHINE, 667 FEET.

THE citizens of Mobile, Ala., are enjoying the luxury of a "war" between the Mobile and the Consumers' ice companies, and during the past month have been buying ice at 10 cents per hundred. Just how the war originated is immaterial. One party accuses the other of cutting the former's price to secure the trade of the Armour Packing Co., who use large quantities of ice in their local cooler. For that cut, retaliation, of course, was made, and the underpinning of prices fell out—to remain out until both companies shall have wasted a good deal of money before coming to their senses again. Meantime tickets are selling *ad lib.* at 25 cents, which are being purchased heavily by speculators who will use them next season at face value, no matter how high the price goes next summer; for both companies predict higher prices for the coming season in spite of the present "war." It may be that to recoup themselves for "war expenditures" such an increase may be necessary; but whether an immediate "declaration of peace" and a suspension of "war expenditures," with strictly fair prices to the consumer all through both winter and summer, would not be a better course, is a thought respectfully suggested to the belligerants. We never heard of a war of any kind that paid any one—except the neutrals who pocket the expenses incurred by the opposing forces.

THE much-talked-of Leiter building, corner State and Van Buren streets, Chicago, now being prepared for the retail house of Seigel, Cooper & Co., will contain two refrigerating machines of a new pattern, made by the Hercules Iron Works, which will not only refrigerate the meat chambers, but also cool the water used for drinking purposes throughout the immense building, as well as all the soda water used during the hot season. This machine will not only cool the water, but will have special machinery newly designed by the "Hercules" works for filtering and clarifying the water, so that in the glass it will be a pure, soft, clear water, absolutely free from all disease germs.

THIS is a good time of year to repair and repaint delivery wagons. Wagons, wheels especially, should be repainted every year to keep them in shape and to avoid the expense of resetting tires. Take off the wheels and lay them on a bench and paint the upper side, allowing the paint to work in between the felloe and tire. By the time all four are treated the first will be dry enough to turn over for painting on the other side. Laying them down is much better than painting with the wheel on the wagon.

THE Charleston (Ill.) Ice Manufacturing and Cold Storage Co. has been incorporated by C. A. Dehaven and others; capital $8,000.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—THE ICE MAKING MACHINE OF CH. A. SEELEY—SOME FURTHER DEVICES AND NEW REFRIGERANTS PROPOSED.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from December issue, page 329.*]

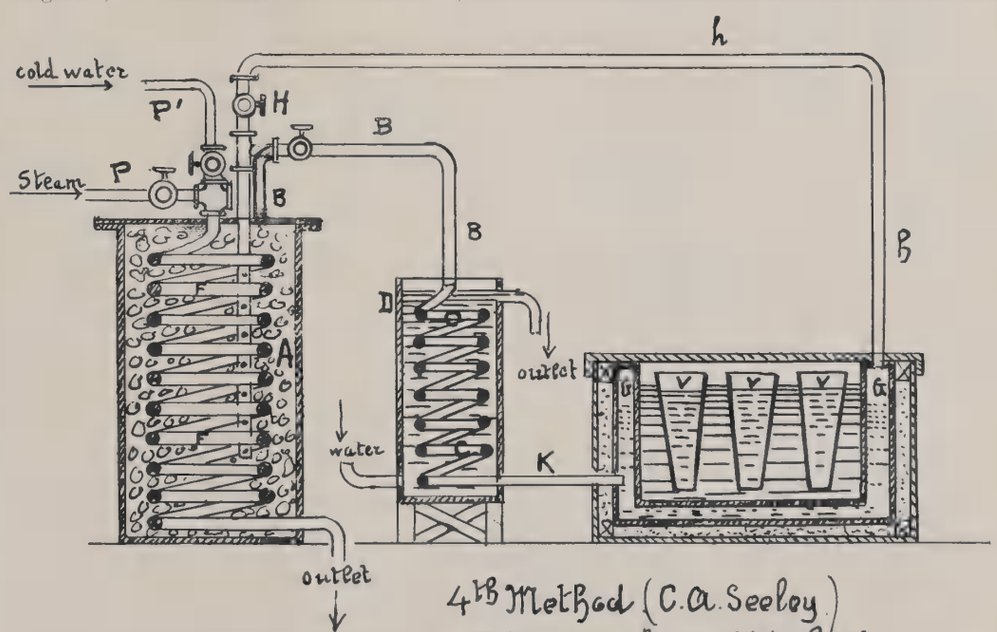
The use of a volatile liquid as a mode of producing cold by mechanical evaporation and compression of its vapors having proved its efficacy by the working in Europe, and especially in England, of the ether machines on a large scale, it was to be expected that the attention of inventors would be directed to the use of volatile liquids other than ether, in apparatuses more or less different, according to the special requirements of each liquid, but, of course, presenting the same general features of arrangement as the Twinning machine.

In 1867, Prof. Van der Weyde took a patent for the use, in a chemical machine, of the lighter products of the distillation of petroleum, such as naphtha, rhigolen, etc., generally known as petroleum ethers; and T. T. S. Lowe for the use of liquefied carbonic acid. It was soon followed, in 1869, by the patent of Ch. Tellier, of France, for the use of methylic ether, and, in the same year, by those of Tait, Gesner and, later on (1877), of Pictet for the use of liquefied sulphurous dioxide, commonly known as sulphurous acid, the gas produced by the combustion of sulphur in the air; in 1870, by that of said Tellier for the use of liquefied gas ammonia in a special apparatus; and, later on, we find patents covering the use of other volatile liquids, such as chloride of methyl (Vincent), methylomine (A. Mühl), trimethylamine (Tellier), etc.

METHOD OF CH. A. SEELEY.

The year 1871 affords us an example of the direct application of the experiment made by Faraday with chloride of silver saturated with ammonia gas (fourth method mentioned). Ch. A. Seeley patented a small machine in which, for the chloride of silver of Faraday, he substituted calcium chloride (much cheaper) as an absorbent of the same gas.

The saturated chloride of calcium is introduced in the closed strong metallic vessel or generator *A* (Fig. 6), provided with coils *FF*, in which, through the pipes *PP*, can be admitted, at the proper stages of the operation, either steam or cold water. This vessel *A* is connected by the pipes *BB* with a coil condenser *C* placed in the vessel *D*, in which water is made to circulate around the



4th Method (C. A. Seeley)
Absorption by a solid Fig. 6.

coil *C*, steam being admitted in the coils *FF* by opening the cock in pipe *P* and closing the cock in pipe *P'*, the gas ammonia is expelled by heat from the calcium chloride, and the gas given off under pressure passes through *BB* in the coil *C*, when it is liquefied by the combined action of the pressure and of the cooling. The liquefied ammonia of coil *C* is then allowed to flow

through pipe *k* in a metallic box *b*, or refrigerator, properly insulated, and of which the sides form a rectangular channel, as shown in figures. The vessels *VVV* containing the water to be frozen are placed in this box, which is filled with an uncongealable brine. When the liquefied gas ammonia has filled to the proper height the rectangular channel *b*, the steam is turned off by closing the valve in *P* and the cold water admitted in the coils *FF* by opening the valve in *P'*. The chloride of calcium of the vessel *A* being thus cooled, its power of absorption of ammonia gas is restored, and if a communication is then established between the freezing box *b* and the vessel *A* by opening cock *H*, the liquefied ammonia evaporates spontaneously, and its vapors, passing through pipes *hh*, are reabsorbed as fast as formed by the cooled chloride of calcium contained in *A*. An intense cold is thereby produced in *b*, which being transmitted by contact with the sides of *b* to the brine of the box freezes ultimately the water of the molds *VVV*. The operation is of course intermittent, and the production of ice limited to small quantities.

FURTHER DEVICES AND REFRIGERANTS.

As time proceeded we see, following the development of chemical and mechanical sciences, new liquids proposed, new devices, new dispositions patented, but all relating to the classes of machines previously described, and not involving any new principles of refrigeration: in fact, all bearing on air machines, volatile liquid or chemical machines, absorption machines.

In 1879 we find an application on a commercial scale of the property possessed by certain salts to produce a great lowering of temperature by being mixed with powdered ice or snow. (5th method.) Eli L. Rankin patented a special contrivance for the construction and maintenance of skating rinks. Many other dispositions have been based on the same principle, though intended for different applications, such as the cooling of cellars, vats, etc., but as they all suppose the use of the natural product—ice—the very product, or its equivalent, which artificial refrigeration intends to supply, we can only give them a passing mention in a history of artificial refrigeration, and merely as illustrating an application of another physical law of matter.

In 1880, we find the application of a somewhat new principle to refrigeration. (T. du Motay & Rossi.) It refers to this class of machines working with volatile liquids (ether and others) by mechanical exhaustion and compression of their vapors. In this kind of machines, as we have seen, the vapors of the chemical are compressed to such an extent by a mechanical device that, being forced into the vessel called the condenser, cooled by a circulation of water, they return therein to the liquid state, re-forming the original liquid. There exists for each volatile liquid a certain pressure, corresponding to a certain temperature of the cooling water, at which their vapors can be liquefied. The greater this temperature the greater also is the pressure required: and the mechanical power necessary to compress the vapor to this pressure bears obviously a defined relation to the extent of that pressure, whatever might be the cooling effect obtained. The more volatile a liquid is, that is, the lower is its boiling point below that of water, the greater also is the pressure required to liquefy its vapors at a given temperature; for instance, that of the circulating water of a condenser. In this system, the refrigerating agent is a compound volatile liquid, obtained by causing a volatile liquid, such as sulphuric ether, for instance, having a boiling point somewhere near 90° F., to chemically absorb the vapors of a much more volatile liquid for which it has affinity, and with which it is not chemically incompatible, such as sulphurous dioxide, ammonia, or carbonic acid, as the case might be—gases which, being liquefied under pressure, furnish liquids having boiling points much below that of the freezing point of water.*

Were such a compound liquid used in an ice machine of the type alluded to, working by exhaustion and compression of the vapors, it can be seen that the vapors of both the constituents will be given off under the exhausting action of the pump, just as was the case with a simple liquid; but when the compression of these mixed vapors in the condenser by the subsequent action of the pump will take place, the vapors being at the same time cooled by the circulating water of the condenser, the *less* volatile of the components (the ether, for instance) will necessarily be liquefied *first* in the condenser at the *minimum* pressure, and, there and then, absorbing by chemical affinity the *non-condensed vapors* of the *more volatile* liquid, will prevent the pressure in this vessel from rising to that degree which would have been required to liquefy the vapors of the more volatile liquid, if used alone, at the temperature of the condensing water. In other words, the power of chemical affinity was intended to accomplish in part the work performed by the mechanical compression. In subsequent patents, sulphurous dioxide, liquefied under pressure and confined in a strong vessel, was used as an absorbent, and carbonic acid as the absorbed gas. (A. J. Rossi, 1886.) In others, the refrigerating agent was even composed of three volatile liquids—ether, sulphurous oxide and carbonic acid (A. J. Rossi, 1885)—but the principle involved was the same as in the preceding case. The machines used to carry this method being exactly of the same kind as those used for simple liquids, we have not to mention them.

(TO BE CONTINUED.)

THE Consumers' Ice Co., of Chester, Pa., seem to have been quite successful in their efforts to improve their artesian well by exploding a dynamite cartridge at its bottom, 450 feet below the surface. As noted in ICE AND REFRIGERATION last month, such experiments, in certain localities, at least, are attended with much danger, the explosions having been known to have ruined wells instead of improving their flow. In the case of the Consumers Co., however, the well, after having been cleared of *debris*, has since yielded a steady flow of sixty gallons per minute of clear, cold water, and is apparently a perfect success.

THE usual Christmas train of poultry for Boston from Smith's Falls, Perth, Brockville, Almonte and Carleton Place, Canada, consisted of twelve cars, containing over 100 tons of poultry, valued at about $26,000.

*Referring to the observations we have had occasion to make on this subject, at the beginning of this examination, we will recall the fact that the *boiling point* of a liquid does not imply the idea that this liquid cannot and does not give vapor to a certain extent at temperatures much below this point, as it is the case with water itself, as we have seen, in certain conditions. The boiling point of a liquid is the temperature at which it would vaporize completely and rapidly if the proper heat were furnished and at the atmospheric pressure, the phenomena being accompanied by the peculiar circumstances attending the "ebullition of water" in these conditions.

[*Written for* ICE AND REFRIGERATION.]

PIPE LINE REFRIGERATION.

AN INTERESTING RESUME OF WHAT THE STREET PIPE LINE REFRIGERATION COMPANIES AT ST. LOUIS AND DENVER ARE DOING, AND HOW THEY DO IT.



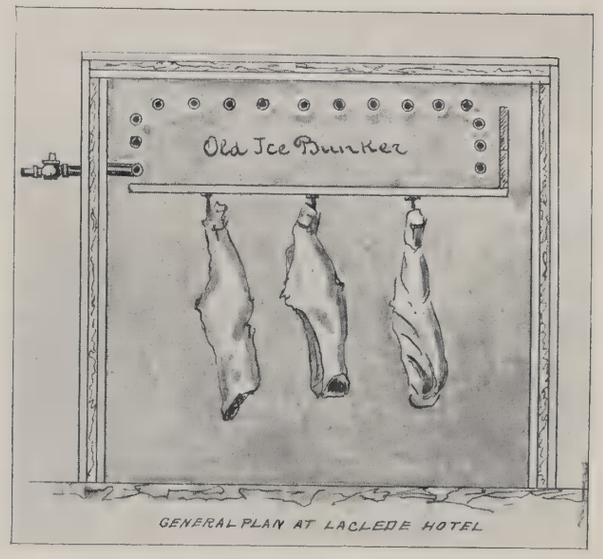
ANY of the present readers of ICE AND REFRIGERATION will doubtless remember an article in the July number of this journal, describing the method of laying mains and supplying service in the system of refrigerating by street mains from a central station, as established in St. Louis and Denver. Great progress has been made in this branch of "the frigid art," and in the two cities mentioned the system has apparently come to stay.

The adaptation of the methods of piping and service connections used in large packing houses and breweries to the multifarious demands of the almost countless varieties of service required by small consumers is in itself a branch of the art, the development of which is of fascinating interest to one acquainted with the business of mechanical refrigeration. The curious problems in the line of special adaptation that are daily presented to the pipe line engineer, are a constant call on his resources and ingenuity. General lines of procedure are, of course, evolved, and almost insensibly general terms are creeping into use, many of which are the outcome of the analogy between the refrigerating service and the electrical service.

The general character of the distribution of the two services is the same—a cycle of flow from the machine around through the mains and back again to the machine, developing commercial results at required points, electricity producing light or power at the lamp or motor, and the refrigerating service taking up heat (popularly, producing cold) in the refrigerators or wherever the expansion piping is placed. As in electrical practice, the refrigerator, or expansion piping, is connected in "multiple" between the liquid line and the vapor line, or several boxes may be connected in "series" between the difference of "potential" (*i. e.*, pressure) of the high pressure liquid and the low pressure vapor pipes. Wherever, as in a restaurant or hotel, several boxes are near together, they are run in "series" in order to save connections and expansion piping; that is to say, several boxes are run from one expansion valve. If expansion piping from one box to the other is exposed to the outer air for a short distance, it is simply covered with a high-class non-conductor of heat. The temperature of the last box has, then, only to be considered in regulating the feed. The temperature of the intermediate boxes is approximated by apportioning the proper amount of expansion piping to the size of the box, and the refinement of temperature adjustment is accomplished by regulating the size of the openings of the circulating flues. Wherever possible, short expansion circuits are avoided, but where unavoidable the automatic appliances for controlling the flow come into play.

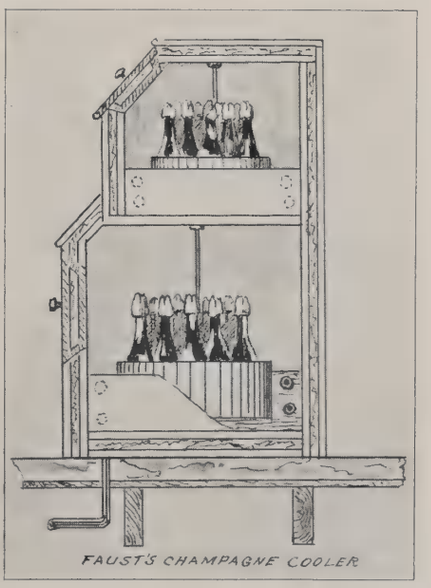
The St. Louis Automatic Refrigerating Co. have laid mains on Second and Third, Market, Elm and Walnut streets, and on Sixth street (one of the principal business streets of the city) from Elm to Olive streets. The principal consumers of refrigeration along the lines of these mains are already fitted up with the service, and others are being connected up as rapidly as possible. The methods employed in adapting the service to the conditions existing at each consumer's refrigerator may be described.

The company takes refrigerators as it finds them. It does not ask that a refrigerator be built for the service, but fits the service to the refrigerator. For example, the large provision and meat boxes in the Laclede hotel



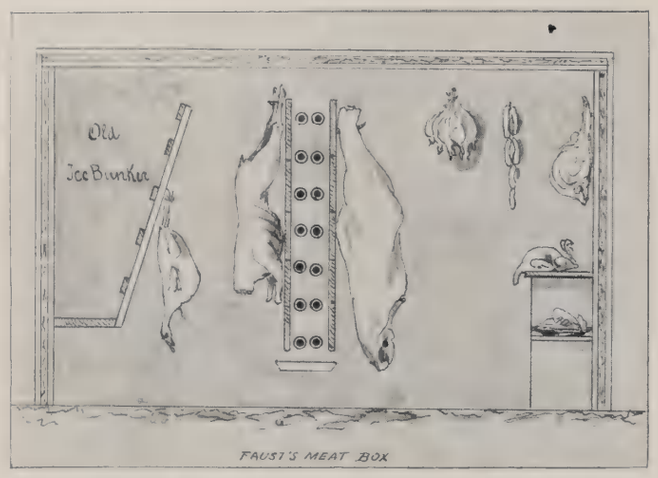
GENERAL PLAN AT LACLEDE HOTEL

are all arranged in a general way, as shown in the cross-section illustration. No carpenter work was necessary to adapt them to the piping system, as the expansion piping was simply placed on the wall and top of the ice bunker, leaving the space formerly occupied by ice entirely clear for storage of goods. The bar and kitchen boxes are also fitted in the same general manner. The method of circulation used when the boxes were refrigerated with ice remains practically unchanged.


FAUST'S CHAMPAGNE COOLER

Some non-residents have a left-handed manner of speaking of St. Louis as "the place where 'Tony Faust's' is." This resort of the disciples of Gambrinus and Epicurus is very thoroughly equipped with the

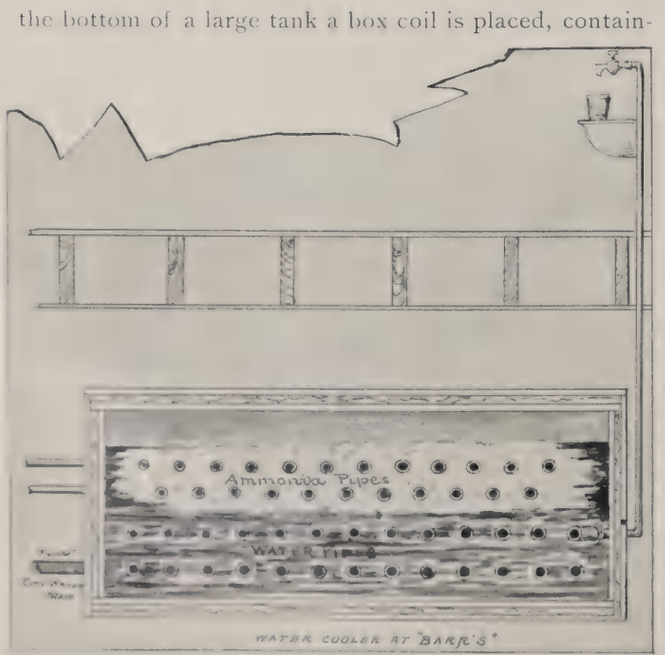
service of the refrigerating company. The large beer vault, lunch and counter boxes and meat refrigerators have been piped for over a year. A novel feature here is the champagne boxes, a cross-section of which is illustrated. The bottles are placed in galvanized iron cases, put together in the form of revolving casters. These casters are partially immersed in brine. The cooling pipes run through this brine, holding it at any desired temperature. In this way the champagne is quickly and thoroughly cooled—"frapped" if desired—and the various brands easily kept separate. The large meat box at this establishment is also illustrated. The



FAUST'S MEAT BOX

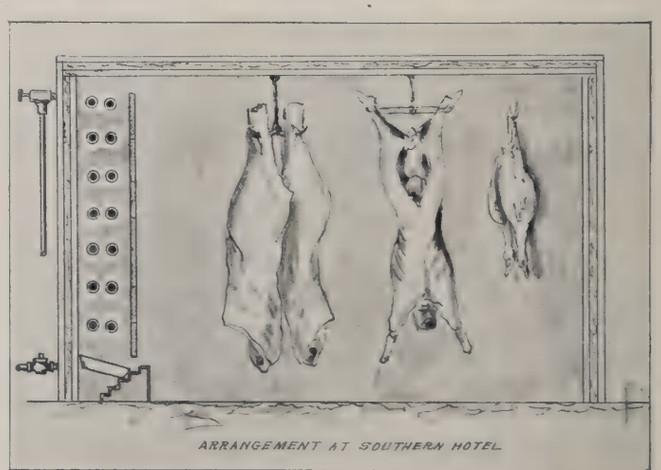
old galvanized iron ice bunker for use of cracked ice and salt is left in position and utilized for storage purposes. The expansion coil runs down the middle of the box, inclosed on each side with circulating bulkheads, so that air is drawn in at the top, and drops out at the bottom of the coil, insuring perfect and rapid movement of all of the air in the boxes over the piping. The bulkheads on the outside help to form the meat racks.

At Barr's dry goods store, on the corner of Sixth and Olive streets, an interesting adaptation of the service is in operation. This is a large establishment, and its customers consume a considerable amount of ice water. In the bottom of a large tank a box coil is placed, containing a considerable amount of galvanized piping. This piping is connected to the city water mains at one end, and outlets at the cold water taps on the floor above. The water is, therefore, drawn at city pressure, and has to be cooled during its passage through the box coil. To eliminate all danger of freezing up the water in the coil, it is submerged about a foot deep in water contained in the tank. The expansion piping is placed just under the surface of this water. When the expansion valve is opened ice forms on the piping, making, in the course of a few hours, a solid cake of ice about five or six inches thick. This reduces the temperature of the water surrounding the box coil to a low point (from 36° to 40°), and so cools the city water on its way to the taps. The ice is never allowed to reach the water coils and freeze them up. This method of water cooling is well adapted to office buildings, where it is perfectly feasible to send cold water to each floor or to each room, if desired.



WATER COOLER AT "BARR'S"

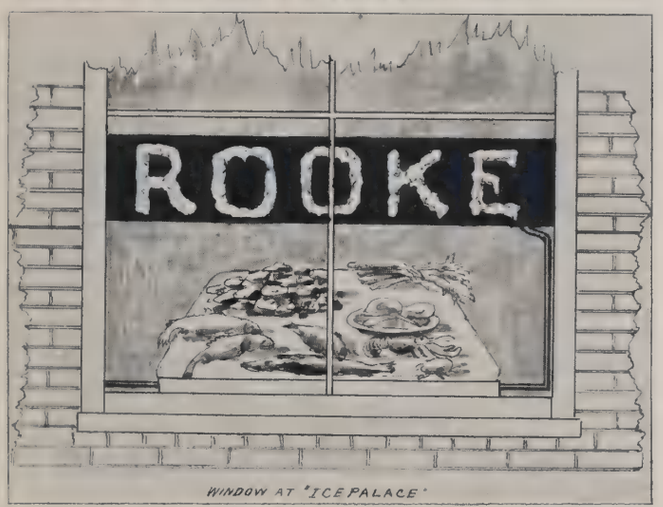
At the Southern hotel is an example of piping in "series." In the basement of the hotel are three large refrigerators, with only a short distance between them. These refrigerators are supplied from a single feed valve, the expansion piping running continuously from one box to the other. In the first two refrigerators the piping is thoroughly cased in circulating bulkheads, and is frosted all the time for its full length through the box. The drip pan at the bottom of the circulator is hinged on one side, and serves as a door, or air valve, to regulate the


ARRANGEMENT AT SOUTHERN HOTEL.

amount of circulation in the manner illustrated. The regulation of temperature in the first two boxes is made by raising or lowering the pan, and so diminishing or increasing the flow of cold air. The third, or last, box in the series is regulated by the feed of ammonia.

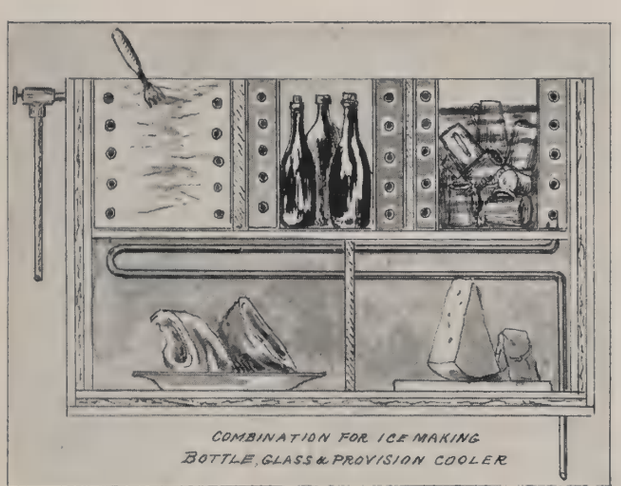
On Market street a café is cooled in summer, in the manner described in a previous issue of this journal, to any desired temperature below the warm outside atmosphere, and it is interesting to note that the same piping that produced the cold is now utilized for steam heating purposes for the winter. A large amount of this kind of business is in prospect for the coming summer. The show window of this café, or "Ice Palace," as it is called, presents a novel feature. A tight galvanized iron box about one inch deep is laid on insulating material. This box, or hollow plate, is filled with strong brine, which has the expansion piping running through it. The surface of the galvanized iron is thus rendered intensely cold, and in the course of a short time a thick coating of frost accumulates on the surface. On this white bed of snow is arranged the daily window display

of game and fish. Above this display expansion piping is bent in the form of letters, so that the owner's name appears in the form of pure white frost. Another curious box is to be seen in a Third street saloon. It con-



WINDOW AT "ICE PALACE"

tains four compartments. In the first, a solid block of ice is formed, which is chipped out as needed with an ice-pick, furnishing cracked ice for bar use. Water is poured in from time to time to take the place of ice chipped out. The water soon freezes, thus keeping up the ice supply. The second compartment is used for a bottle cooler, and the third contains water reduced to a temperature of about 35°, in which "steins" and glasses are cooled. The fourth and lower section is a refrigerator, used for storing material for the lunch counter.


COMBINATION FOR ICE MAKING
BOTTLE, GLASS & PROVISION COOLER

Along the mains of the Colorado Automatic Refrigerating Co., of Denver, which employs the same system, are seen many interesting features. At the Denver Club the refrigerators are all supplied with this service, including freezers for game and fish. This club is also supplied with apparatus for freezing water in *carafes* for table use, a promising branch of the service. They also have a miniature ice factory, except that the power comes from the street mains instead of from a local machine. They have a regular brine tank with fifty-pound cans, from which all the ice used in the club is taken. A similar service is also given to other customers who need considerable ice to crack up.

The A. Booth Packing Co. have two large freezers supplied by this system, where salmon, trout and all kinds of fresh fish are frozen at a temperature of about 10° Fahrenheit, and after being frozen are kept at a temperature of about 20°. The Denver Fish Co. have three freezers of about 5,000 cubic feet capacity, operated in the same way. The Windsor hotel is also thoroughly equipped with the service. A striking feature here is the arrangement behind the bar, the entire "working table" being supplied with the ammonia piping. Bottles constantly in use are placed in cases open at the top and immersed in brine. Champagne coolers are also provided.

These examples serve to illustrate some of the many interesting features of a service that seems destined to be an important feature in the refrigerating business. In both St. Louis and Denver extensive additions are being made to the central plants and pipe lines. At the latter point, machinery is now being placed in position, increasing the plant by an additional cooling capacity equal to the meltage of 100 tons of ice daily. A similar increase of capacity has been recently completed in St. Louis, and active preparations are going on in that city to build a new central station of about 500 tons daily capacity, and to extend the mains so as to cover the main eastern business portion of the city.

AN EXHILARATING FLUID.

Free ammonia played high jinks on Lake street this morning, said a Chicago evening paper recently. A carboy of the pungent stuff came to grief before the Old Salamander drug house, and in a second the sidewalk in front of the store was flooded with the liquid.

A cadaverous cur with fond visions of thanksgiving bones and scraps before him happened along just as the ammonia burst from the broken carboy. His inquisitive nose investigated the innocent looking stream; there was a quick yelp of pained surprise, a beautiful demonstration of retrograde celerity, and with his fore paws clutching the ambient atmosphere and his hind legs doing an aerial double shuffle, the shampooed canine fled toward Clark street.

A curious dray horse standing before the store saw the stream flowing toward the gutter, and put his nose into the business. There was a snort, a rise in the air, a series of blurting coughs, and the horse lit out for fresh air with a teamster of unlimited vocabulary running after him.

The fumes of the ammonia were wafted for blocks, and Lake street for a time resembled a rendezvous for hay fever aristocrats. The gentle car horses sniffed the exhilarating odor, and the Lake street cars bowled along as if they were on a kite track; while a weary North-sider feebly suggested, "Put a little on the cable."

THE growth of the California orange trade since the adoption of refrigerator cars for carrying the fruit east a few years ago, is well indicated by the recent publication in the *Citrograph*, of the complete returns of shipments (1890–91) from the six counties comprising South California. The returns show shipments of 1,312,099 boxes, or 4,593 cars, which does not include 20,904 boxes, or 702 cars, of lemons. The season before (1889–90), only 2,849 cars were shipped. Los Angeles is the banner county, having shipped 632,071 boxes, or 2,212 cars, with San Bernardino county second, with 487,882 boxes, or 1,708 cars.



[*Written for* ICE AND REFRIGERATION.]

WORKING WITH AMMONIA.

IN WHICH ICE MACHINES ARE THE PROCESS OF REFRIGERATION CARRIED ON IN THE BEST WAY—AN INQUIRY INTO THE THEORETICAL AND ECONOMICAL CONDITIONS.

BY A. SORGE, MECHANICAL ENGINEER.

A short time ago the writer of these lines had occasion to compare the state of the ice machine industry of America with that of Germany; and he found some surprising and interesting points, which are, however, in complete harmony with the differences that may be observed in industry generally, of the two countries, namely: The largest and most magnificent plants in America; the most perfect and economical plants in Europe. These facts, or conditions, are caused by the richness of natural resources and plenteousness of available capital here in America; and the abundance of hand work and scarcity of natural resources in the Old Country.

Although you may not often find in this country such large plants as those of Anheuser-Busch, St. Louis, or Swift & Co., Chicago, plants of 150 to 200 tons are not unusual; but in Europe plants of even the latter size are seldom seen. On the other hand, you find even in the smallest engine rooms of the Old Country, only first-class engines, with the most exactly working valve gear, and generally with condensation; and this, too, even in those countries where operators have what we would call in America, very expensive cooling water. There you may often find the most ingenious installations for the purpose of saving cooling water. And as to the ice machines themselves, you may observe everywhere that operators endeavor to get only the most perfect, and those which work most economically. This effort has caused in late years the most scientific and exact tests of different systems of ice machines—tests which show that the most popular systems of Europe are indeed the best: The compression machines working with ammonia. Now it is true that you find in the Old Country only two kinds of ammonia machines, viz.: Absorption machines and compression machines working with humid vapor. Those machines which are most popular in this country, the machines working with overheated vapor, you do not find in Europe at all, although efforts have been made to introduce them there without success. It is the purpose of these lines to show theoretically the difference between these three kinds of ammonia machines.

It is necessary to say only a few words about the absorption machines, as there are but few persons that are not convinced of the inferiority of these machines as against the compression machines. In the former machines the process of carrying on the work is, as is known, the following: In a boiler filled with highly impregnated ammoniacal water, the ammonia gas is driven out by heating the water to a rather high temperature. This heating causes a high pressure of the gas, which pressure, in connection with the cooling water of the condenser, liquefies the ammonia. In the same way as in the other machines, this liquid ammonia evaporates in the refrigerator: but instead of being sucked by a pump (the compressor), the evaporated ammonia is removed by being absorbed by the same water from which it had been driven out at the beginning of the process. To make possible this absorption, the water must be cooled down from that high temperature to a far lower one, and this causes a considerably higher consumption of cooling water than in compression machines. Besides this quantity these machines need the same water the other systems need in the ammonia condenser. And, secondly, this new formed ammonia water must be again heated to drive out the gas; and as the quantity of water is about twenty-five pounds for each pound of gas it has absorbed, one readily sees that a considerable loss of heat is caused by this heating of the absorbing water. You will notice that this amount of heat by no means corresponds to the work needed for the compression machines: thereto corresponds only that amount of heat which is used in the absorption machines to heat the ammonia itself, and to give to it the pressure needed for liquefying it. Besides, there is still another loss in the absorption machines, caused by the fact that you cannot utilize the expansive power of the steam as you do in the steam motors of other systems. So there is no doubt that these absorption machines are not apt to compete with the other ammonia systems, especially as the compression machines are much more easily operated. But it must not be forgotten that the absorption machines played a very important part in the development of the ice machine, although their day of general usefulness is now past.

Before going on to examine which of the two kinds of compression machines is the best—the machines working with humid vapor, or those working with overheated vapor in the compressor—we must first explain what a "humid vapor" is, and what is an "overheated vapor." Both are gaseous substances, originated from a liquid; but the "humid," or, as they are also called, "saturated vapors," are still in connection, or mixed, with the originating liquid, the overheated vapors are not in such connection. Both kinds meet together in a state which we call "just dry." For instance, if you have in a steam boiler actively boiling water, then you will get in the steam dome a mixture of steam and water. This we call "humid, or wet, vapor." But if you cease adding heat the movement of the water will cease, and all the minute drops of water which are mixed with the vapor will fall down to the water till the vapor contains no water, but is really only steam, which we now call "just saturated." or, as we can also say, "just dry," vapor. If you now separate this vapor completely from the water, the vapor, of course, will not change its state; but if you heat it, it will do so, and then it is called "overheated vapor." If you should heat this overheated vapor exceedingly high, then it would become more and more a "gas"; that is to say, the same as, for example, is oxygen. Although "overheated vapor" and "gas" have no essential difference, we must make this distinction, as their physical attributes are different.

The different gases have their boiling point at many different temperatures; and so you find, at the ordinary temperature, gases and overheated vapors, as well as humid vapors and fluids, and a great many substances can easily be brought into four states, as we have seen to be the case with water. So it is also with the ammonia used in an ice machine, where it takes the condition of fluid, of humid vapor, and of overheated vapor, but never does it reach the state of gas. (We scarcely find to-day any ice machine working with gas, as those machines have great disadvantages, as you will likely learn from the old machines working with atmospheric air.)

These three kinds of gas differ in their relations of pressure, temperature and volume; and that is of the highest importance in considering the theory of ice machines. As I intend to speak in these lines only of ammonia machines, and as these machines never work with what we called just now "gases," I will examine the mentioned relations for humid and for overheated vapors of ammonia; and will do it in the following results of the researches of Prof. Zeuner, who examined this subject in the most exact and clearest manner in his work "Technische Thermodynamik."* In his theories and researches, Prof. Zeuner based his calculations upon the researches and experiments of Ledoux, and especially of Regnault. Of course, this is not the place to give an enumeration of Zeuner's theories, and we must restrict ourselves to giving the results only, leaving it to the reader to study the book itself. All the following formulas are given by Zeuner; but as Zeuner gave them all for metrical values, we have changed them so as to use them directly with the units in use here in America.

*"Technische Thermodynamik." Von Dr. Gustav Zeuner. Leipzig: Verlag von Arthur Felix. 1887 and 1890.

Now let us consider at first the saturated vapors of which we find the most important characteristics in the the fact that the pressure of the gas only depends on the temperature, and not on the volume. Zeuner gave for all saturated vapors the formula:

$$\log. p = a - b\, k^{a} + c\, h^{a} \qquad (1)$$

For any figure on the right side of this equation he gave for several substances values found in an empirical way. For ammonia these values are:

$$\left.\begin{array}{l} a = 3.84388 \\ \log. b\, k^{a} = 0.374744 - 0.001946\, t \\ c\, h^{a} = 0 \end{array}\right\} \qquad (2)$$

Here, as in all formulas of this writing p is the absolute pressure of the vapor in pounds per square inch (that is, the pressure above vacuum), and t is the temperature in Fahrenheit degrees. In using this formula, we have an easy way to find the pressures for each temperature.

Other values needed for our examination are the following:

Every substance needs for its evaporation a certain amount of thermal units, the latent heat of evaporation, of which one part is used for surmounting the exterior resistance. This part is found:

$$D\, p\, u = 52.094 + 0.07773\, t - 0.0001305\, t^{2} \qquad (3)$$

D is the value $\frac{1}{5.3\,8}$, p and t are the same as in (1) and (2), and u is the difference of the volume v' of 1 lb. of saturated gas and of the volume w of 1 lb. of liquid at the temperature t, both volumes in cubic feet:

$$u = v' - w \qquad (4)$$

The other part of the latent heat is used for enlarging the amount of the thermal units of the temperature t against the corresponding value of the liquid. This we call interior latent heat, and we find it

$$z = 532.56 - 0.55319\, t - 0.002488\, t^{2} \qquad (5)$$

Both parts give the total latent heat r

$$r = z + D\, p\, u \qquad (6)$$

These three values $D\, p\, u$, z and r, give the number of thermal units, and refer to 1 lb. In explaining the value u we called the volume of 1 lb. of liquid w and the volume of 1 lb. saturated vapor v'. The reciprocal values give us the weight of 1 cubic foot of liquid (g) and of 1 cubic foot saturated gas (f), both in pounds.

As to the value of g and w, Zeuner supposes them to be invariable with the temperature—a supposition that will be sufficient for our practical purposes, as the changes are only exceedingly small ones. We do the same, and take Zeuner's values:

$$w = 0.0256 \quad v\, g = 39.07 \qquad (7)$$

If we have in 1 lb. x lbs. saturated vapor and $(1-x)$ lbs. humidity, then for two different states of the vapor the relation existing is:

$$y_2 + \frac{x_2\, r_2}{T_2} = y_1 + \frac{x_1\, r_1}{T_1} \qquad (8)$$

In this equation T is the absolute temperature (the temperature t of the Fahrenheit thermometer + 459.5°), r is the latent heat of evaporation, and y is a value found on the formula

$$y = 7.8146 + 0.004654\, t - 2.93543 \log. T \qquad (9)$$

At last we have the formula

$$V = x\, u + w \qquad (10)$$

And if we now still keep in mind that the specific heat of ammonia vapor at constant pressure is:

$$\left.\begin{array}{l} c_p = 0.5048 \\ \text{and the same at constant volume:} \\ c_v = 0.3913 \end{array}\right\} \qquad (11)$$

and that the specific heat of liquid ammonia is found in the formula:

$$c = 0.8634 + 0.004654\ t \qquad (12)$$

then we have all the bases for our following examinations. For some other examinations, which are not in the sphere of our present purpose, we use still the conception of "heat of liquid" which we find in the formula:

$$q = 0.86351\ t + 0.002326\ t^2 \qquad (13)$$

For overheated vapors the relation between pressure, temperature and volume is given in the equation:

$$pv = 0.6663\ T - 0.7450\ p^{0.3665} \qquad (14)$$

T and p having the same signification as above, and v being now the volume of 1 lb. overheated vapor. For two different states of the gas, we have the relation:

$$\left(\frac{T}{T_1}\right) = \left(\frac{p}{p_1}\right)^{0.2442} \qquad (15)$$

All these formulas form the basis for the examination of the processes in our ammonia compression ice machines.

Every one knows that in these machines the task of the compressor is to give to the evaporated gas the high pressure which is necessary, in connection with the influence of the cooling water to liquefy it. The liquid so formed goes from the condenser to the refrigerator, in order to evaporate again. This quantity of liquid ammonia is regulated by means of a valve, and this regulation depends on the amount of ammonia the compressor sucks from the refrigerator. Of course upon this suction capacity of the compressor depends the amount of liquid that evaporates in the refrigerator. Now you can readily see that you can regulate your valve in such a way that you can let pass just the same quantity of liquid which evaporates in the refrigerator. In this case, the gas entering the compressor will be "just saturated." If you throttle your valve more, then less gas evaporates in the refrigerator than corresponds to the capacity of the compressor. In this case, there takes place in the refrigerator, not only an evaporation, but also an expansion; and the result is that the compressor is entered by an overheated vapor; or, as we will now say, according to the use in practical life, overheated "gas." But your regulating valve can be opened still more, as in the first case, and then you will have an abundance of liquid entering the refrigerator that cannot evaporate. This liquid will, if the machine is in regular working, remain liquid, and make the vapor, or gas, entering the compressor, a humid one.

I scarcely think that there are ice machines working according to the second way; but there are some machines in which the gas coming from the refrigerator is heated by the cooling water that is going to the condenser. In this case, indeed, you will have an overheated gas entering the compressor; but this working seems to be the worst, as the heat the gas needs for expansion is not taken from the substances to be cooled. The justification that in these machines the cooling water for the condenser is cooled, and therefore the pressure in the condenser, which is given by the quantity and temperature of the cooling water, will become a lower one, is a thoroughly false one; for the heat taken from the cooling water passes into the ammonia, and, instead of remaining in the cooling water, comes back to it in the condenser after having only augmented the power needed for the compression in the compressor.

So I need only speak of those compressors sucking "humid" gas and those sucking "just saturated" gas; and the more so, as every one who wishes to learn the same for "overheated" gases can find it by using the formulas above given.

Now, let us consider an ice machine at one time sucking a humid gas and then a just saturated one, with all apparatus, including the compressor, and all the temperatures and pressures, being the same: and this machine we will examine under the supposition of certain values by using the formulas above given. Suppose—

The temperature in the refrigerator, $t_1 = -4°F.$
" " " " condenser, $t_2 = +86°F$ (16)
" capacity of the compressor Q 5 cubic feet,

and I suppose that the valves have no influence upon the pressure; that is to say, that the pressures in the suction pipe and in the discharge pipe are the same as in the compressor. In using the formulas (1) and (2) we find

The pressure in the refrigerator, p_1 27.03 lbs.
" " " " condenser, p_2 170.80 lbs. (17)

In the machines working with humid gas, we chose the humidity of the sucked gas in such a way that the gas, at the end of the compression period is just saturated (and we can do it by corresponding throttling of the regulating valve); then we know that the temperature of this gas must be the same as in the condenser, as in both the gas is saturated and has the same pressure. For the two temperatures $t_1 = -4°$ and $t_2 = +86°$, we find in using formulas (3), (4) and (7)—

$$u_1 = 10.270 \quad u_2 = 1.814$$
$$v_1 = 10.296 \quad v_2 = 1.840 \qquad (18)$$

and if we now keep in mind that

$$T_1\ 459.5 - 4 = 455.5 \quad T_2 = 459.5 + 86 = 545.5 \qquad (19)$$

we can figure out from (9)

$$y_1 = 10.0075 y_2 = 0.1815 \qquad (20)$$

Now we just claimed that in working with humid gas it shall be just dry saturated at the end of the compression period: that will say that

$$x_2 = 1 \qquad (21)$$

Then we find in using formula (8) the needed humidity of the sucked gas (the gas at the beginning of the compression)

$$x_1 = 0.8933 \qquad (22)$$

These two values, x_1 and x_2, now give us the volume which one pound gas takes in the two states; and we find with (10)

$$V_1 = 9.200\ cb.\ ft. \quad V_2 = 1.840\ cb.\ ft. \qquad (23)$$

Above I supposed the capacity of the compressor to be

$$Q_1 = 5\ cb.\ ft. \qquad (24)$$

As this is the volume of the sucked quantity of gas which we had to compress to the condenser pressure, we see clearly that if Q_2 is the volume of the gas at the end of the compression, the equation must be:

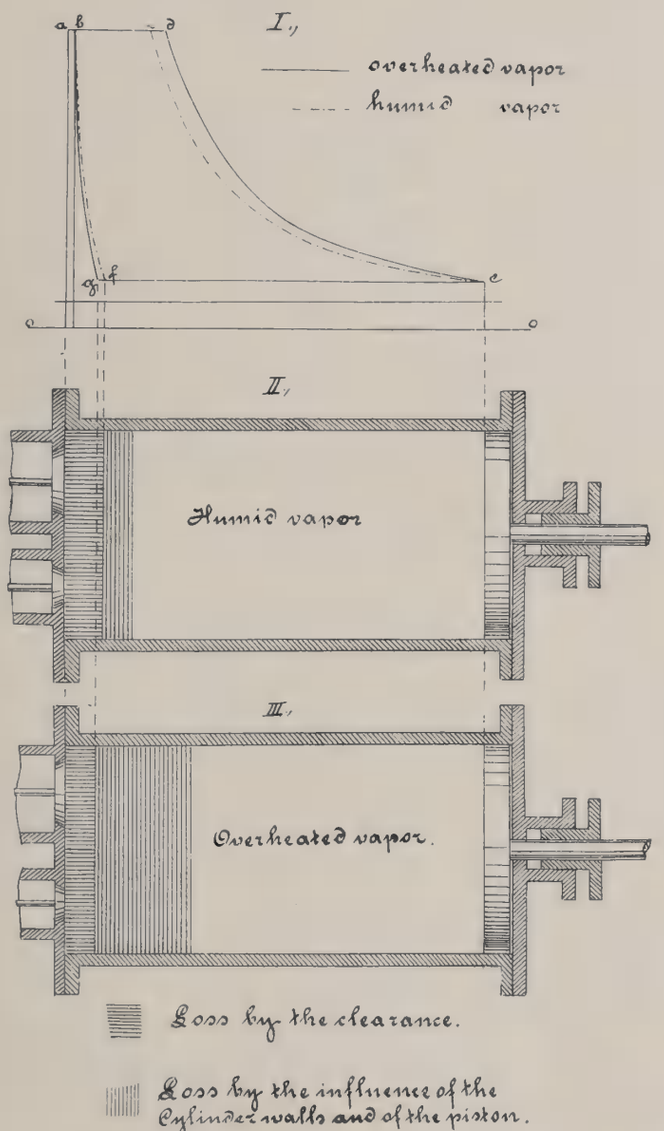
$$Q_1 : Q_2 = V_1 : V_2 \qquad Q_2 = \frac{Q_1 . V_2}{V_1} \qquad (25)$$

therefore,

$$Q_2 = 5 . \frac{1.840}{9.200} = 1.000\ cb.\ ft. \qquad (25a)$$

In the same way we can figure out pressure, humidity and volume for all other temperatures between $-4°$ and $+86°$; and if we construct a diagram by taking for the different temperatures the volumes as abscisses and

the pressures as ordinates, we get an exact representation of the compression curve. In this way we found the curve *c e* of diagram below:



Of course, every compressor has a clearance which is, in the beginning of the suction period, filled up with gas of the compressed state. If, now, the piston goes back, this gas will at first expand to the pressure in the refrigerator, and only after this gas has reached this pressure, will the suction valve open. So we see the bad influence of the clearance. The expansion curve can be figured out in the same way as that of the compression. The clearance is supposed to be

$$m_2 = 0.02 Q_1 \qquad (26)$$

You may easily find the value of the expanded gas—

$$m_1 = \frac{0.02\, Q_1 \,.\, V_1}{V_2} = 0.5 \text{ cb. ft.} \qquad (27)$$

In the same way you can find all other periods of the curve *b f* of the diagram.

Up to this time I supposed the wall of the compressor and the piston to be without influence, but, of course, both will be heated in the compression period; and if the piston, at the next stroke goes back, the new gas entering from the refrigerator will be heated. To tell the amount of this heating is not possible at present, as we do not know completely all corresponding circumstances, although Zeuner and others have shown a way to get the knowledge of these. For our purpose it is sufficient to make any supposition, and we will assume that the walls, etc., keep so much heat as is sufficient to heat the new gas to a temperature t_x:

$$t = \frac{t_1 + t_2}{2} = +41 \qquad (28)$$

As the gas is humid, the pressure cannot change; therefore, all this heat can only be utilized to evaporate a certain quantity of humidity, and this quantity is found as follows:

We found above that in 1 lb. of gas at the beginning of the suction period had to be 0.8933 per cent gas, and 1 — 0.8933 per cent humidity. The capacity of the compressor is 5 cubic feet. In (23) we saw that 9.200 cubic feet have a weight of 1 lb.; therefore, the five cubic feet in the compressor have a weight of

$$G = \frac{5}{9.200} = 0.5435 \text{ lbs.} \qquad (29)$$

This is the total weight of gas and liquid. According to $x = 0.8933$ the weight of the gas is

$$G_1 = 0.5435 \,.\, 0.8933 = 0.4855 \text{ lbs.} \qquad (30)$$

and the weight of the liquid:

$$g_1 = 0.5435 - 0.4855 = 0.0580 \text{ lbs.} \qquad (31)$$

Now we supposed the heat contained in the cylinder walls from the compression period to be just enough to heat this mixture of gas and liquid to 41°. As we find with (12), the specific heat of liquid ammonia at —4°,

$$c = 0.8448. \qquad (32)$$

and as we knew from (11) the specific heat of ammonia gas at constant pressure,

$$c_p = 0.5048, \qquad (12)$$

we find the amount of thermal units represented in the heating of the gas,

$$s_1 = 0.4855 \,.\, 41 \,.\, 0.5048 = 10.0484, \qquad (33)$$

and for the liquid,

$$s_2 = 0.0580 \,.\, 41 \,.\, 0.8448 = 2.0089, \qquad (34)$$

or

$$s = s_1 + s_2 = 12.0573, \qquad (35)$$

With (3), (5) and (6), we find the latent heat of evaporation at —4°.

$$r_1 = 586.5. \qquad (36)$$

If this figure, 586.5, is the amount of thermal units needed for the evaporation of 1 lb. liquid, the proportion

$$\frac{s}{r_1} = \frac{12.0573}{586.5} = 0.0206 \text{ lbs.} \qquad (37)$$

gives us the number of pounds evaporated in consequence of the influence of the cylinder walls and of the piston. They enter the compressor as liquid, and in this state their volume can be neglected, but after having evaporated, the volume of these 0.0206 lbs. is found, using (18)—

$$V_x = 0.0206 \,.\, 10.296 = 0.212 \text{ cb. ft.} \qquad (38)$$

It is obvious that the two volumes occupied by the gas expanded from the clearance and by the gas evaporated by the influence of the walls, etc., represent a loss of refrigerating capacity of the compressor, which, instead of sucking its whole contents, sucks only

$$Q^1 = Q_1 - m_1 - V_x \qquad (39)$$

In our example, instead of 5 cb. ft. are sucked only

$$Q^1 = 5 - 0.5 - 0.212 = 4.288 \text{ cb. ft.} \qquad (39a)$$

Now we make the same calculation for the working with a gas just saturated when entering the compressor. We make the same supposition as above in (16) and (17), but in this case only the pressure of the gas is the same in the condenser and in the compressor at the end of the compression period: the temperature is different. We find it in the compressor with (15). In putting in

$$T_1 = 455.5 \quad p_1 = 27.03 \quad p_2 = 170.80$$

we find

$$T_2 = 714.5 \tag{40}$$

or

$$t_2 = 255.0^\circ \text{ F.}$$

With this value, and with (14), we find

$$V_2 = 2.500 \text{ cb. ft.} \tag{41}$$

The volume of the gas entering the cylinder we find, as this gas is just saturated, that will say $x = 1$, in using the formulas (3) and (4),

$$v_1 = V_1 = 10.296 \text{ cb. ft.} \tag{42}$$

As these are the volume of 1 lb. gas, the sucked 5 cu. ft. gas will have at the end of the compression period a value of

$$Q_2 = \frac{Q_1 V_2}{V_1} = \frac{5 \cdot 2.500}{10.296} = 1.214 \text{ cb. ft.} \tag{43}$$

Now we find, as the first result of our calculations, *that the volume of the compressed overheated gas is a larger one than that of humid gas:* and as we can figure all the other temperatures and pressures between p_1 and p_2, and as we will find them larger, as in the first case, and as the diagram you get with these volumes and pressures represents the needed work for compression, this work is *a larger one in dry gas machines than in humid gas machines.*

In the same way we can figure out the influence of the clearance. The volume of the gas which filled up this clearance at the end of the compression period will expand in the beginning of the suction period to the pressure in the refrigerator. Then its volume will be —corresponding to (27):

$$m_1 = \frac{0.02\, Q_1 \cdot V_1}{V_2} = 0.412 \text{ cb. ft.} \tag{44}$$

In the same way we can find the other points of the expansion curve $b\,g$, and, if we compare this with that of the last case, we see that there the influence of the clearance is a little higher one.

Now, we will examine the influence of the cylinder walls and of the piston, which, in this case, are much more heated than in the first. (Compare T_2 (19) and T_2 (40).) As with the difference between the temperatures of two differently temperated substances, the influence of the higher temperature to the lower augments, the influence of the cylinder walls will now probably be a greater one to the new gas than in the first case; but we suppose the same influence as above, and, therefore, we assume the new gas heated to the temperature

$$t_x = \frac{t_1 + t_2}{2} = 125 \tag{45}$$

In the first case the corresponding heating was utilized for evaporating a certain quantity of humidity; in this case, we have only just saturated gas, and that is a dry gas. Therefore, the influence of the cylinder walls can be utilized only for augmenting the temperature of the sucked gas to the temperature $t_x = 125°$. As during the suction period the suction valve is open, the pressure in the suction part of the compressor must be the same as in the refrigerator, and the influence of the said heating can only be an enlarging of the volume. This enlarging we find again by means of the formula (14), which gives us for the temperature $t_x = 125°$ and the pressure $p_1 = 27.03$ lbs. the volume of 1 lb. gas:

$$V_x = 14.284 \text{ cb. ft.} \tag{46}$$

In taking notice of (44) we see that the capacity of the compressor filled with new gas would only be, in consequence of the influence of the clearance

$$Q_1' = Q_1 - m_1 = 4.588 \text{ cb. ft.} \tag{46a}$$

But instead of being filled up with gas of the weight of the refrigerator gas, for which we found in (42)

$$v_1 = V_1 = 10.296 \text{ cb. ft.} \tag{42}$$

this volume is only filled up with gas of a state

$$V_x = 14.284 \text{ cb. ft.}$$

and this is the same as if gas of the state of the refrigerator gas would only fill up a room

$$Q' = \frac{Q_1' \cdot V_1}{V_x} = \frac{4.588 \cdot 10.296}{14.284} = 3.307 \text{ cb. ft.} \tag{47}$$

Comparing this value with the value Q' found in (39a) we see, as second result of our calculations, that the *machines with dry gas have a smaller suction capacity, and, therefore, also, a smaller refrigerating capacity* than the others.

Of course we must now have to figure out the compression curve for the gas of $t_x = 125°$ temperature in the beginning of the compression; then, using again formula (15), we find for this case as temperature,

$$T_2' = 918° \tag{48}$$

and with (14) the corresponding

$$V_2' = 3.2941 \text{ cb. ft.} \tag{49}$$

and, further, the volume of the compressed gas, instead of (43)

$$Q_2' = \frac{5 \cdot 3.2941}{14.284} = 1.153 \text{ cb. ft.} \tag{50}$$

In (43) we found

$$Q_2 = 1.214 \text{ cb. ft.}$$

If we now construct in Fig. 1 with this value $Q_2' = 1.153$, and with the other values Q' belonging to the pressures between p_1 and p_2 the compression curve $d\,e$, then in the surface $b\,d\,e\,g$ we get the needed work represented; the surface $b\,c\,e\,f$ gives us the corresponding work for humid gas, and the difference between both surfaces shows us the difference between the needed work in both kinds of machines. In our instance this difference is about 14 per cent: that is to say, *the work needed in the compression machines with overheated gas is larger than the work needed in the compression machines working with humid gas.*

In Fig. II and Fig. III you find represented the compressor with the losses caused in both cases by the influence of the clearance and of the cylinder walls and the piston. But it is well to notice, that we had to make here a similar correction as we have made in getting the value Q_2' and this would show that the sucked weight of gas is still a smaller one than we had found in (47). This, however, would carry us too far; for it would cause another correction of the value Q_2'; and it would be unnecessary, as we only intended to show the principle the two kind of machines are working with and as we do not know the real influence of walls and piston. So we represent in the unlined spaces of the Figs. II and III only the values Q' as we have found them in (39a) and in (47), and then these spaces correspond to the

suction capacity, or, which is the same thing, the refrigerating capacity. As we found both these values for humid vapor machine, $Q^1=4.288$ cubic feet, and for overheated vapor machines $Q^1=3.307$ cubic feet, we see that the refrigerating capacity of the latter is about 23 per cent less than that of the first.

Of course we by no means claim these two figures to represent the difference between the two kinds of machines. They count only for the chosen instances, and upon the supposition of the said influence of the cylinder walls. This influence, in fact, may be another one, but it is indisputable that it is, at all events, a greater one in machines with overheated gas than in the others, on account of the greater difference between the two temperatures.

To reduce these disadvantages so far as possible, the dry gas machines are generally fitted up with a water jacket, but of course they do not succeed in avoiding the said disadvantages entirely, as you may judge from the exceedingly high temperature of the discharged gas, and from the fact that they do not cool the piston, which would be possible only by means of a very difficult construction. Besides, the cooling of the cylinder walls causes a rather complicated construction.

As to the machine working in such a way that the compressor sucks not only dry gas, but overheated gas, it can be easily seen, in following the above enunciation, that their efficiency must be a still smaller one, for, in this case, both the temperature of the compressed gas, and the loss on account of the larger volume of 1 lb. gas in the beginning of the compression period, must be augmented, compared with the machines sucking only just overheated gas.

So we say that there can be no doubt that at the present state of the ice machine industry, the ammonia machines working with humid gas are the best. To give the amount of the difference between their efficiency and that of the others, would only be possible by making exact tests under exactly the same conditions—a task that can hardly be carried out in practical life. The best way to do it would be to erect an establishment, such as you find in Munich, Germany, where such tests are made only by an impartial and scientific commission, and in the United States there would be the very best opportunity to erect such an establishment at the World's Fair.

Such tests would surely show, and in a practical way also, what we have found in the preceding lines, *that the only good and economical way to carry on the refrigeration process is to work with humid gas in the compressor.*

It is not often, perhaps, that political honors are thrust upon the "ice man," but when they come the recipient is supposed to be made happy and content; nevertheless Mr. Chas. H. Turner, formerly in the ice trade at New York, who has been made door keeper of the house of representatives at Washington, is said not to be happy—in fact, his life temporarily is a burden, and all because the "boys with a pull" in New York are clamoring for all the minor offices at his disposal, and will not be put off with the statement that these berths are distributed among the states in proportion to the vote cast for the party in power. "See?" Mr. Turner has our sympathy in his predicament.

While the bulk of Ontario eggs are now going to England, the provinces of New Brunswick, Prince Edward's Island and Nova Scotia are shipping largely to Boston, in spite of the duty of 5 cents per dozen. Prince Edward Island has shipped to Boston over 640,000 dozens by one steamship line alone, which is greatly in excess of the total shipments last year, and has also sent immense quantities by other steamship routes and by rail to the United States.

The state Board of Trade of California has organized the California Foreign Market Co. the object of which is to introduce California fruits (fresh and dried), wines, etc., to the European markets. The first agency will be established this year in London, from which center "exploration" of the continental markets will be made, in order to point out to private enterprise the way to occupy the ground.

NEW BOOKS.

"Experiments in Aero-Dynamics." By S. P. Langley. Washington: 1891. Published by the Smithsonian Institute. Quarto, cloth, 115 pp.

This volume is No. 801, of the Smithsonian Series, forming part of Vol. XXVII of the "Smithsonian Contributions to Knowledge." The object of this interesting memoir, the elaboration of which has claimed the author's leisure time for several years, is to demonstrate experimentally certain propositions in aero-dynamics which prove that such flight under proper direction is practicable. The author's investigations have led to the result that mechanical sustentation of heavy bodies in the air, combined with very great speeds, is not only possible, but within the reach of the mechanical means we actually possess. The experiments and deductions of the author possess great interest. They are fully described and amply illustrated by fifteen large plates.

"Electrical Rules, Tables, Tests and Formulæ." By A. Jamieson. New York: The Industrial Publishing Co. 12mo, cloth, pp. 64.

This little compilation, which is well illustrated, will be found a very convenient companion to all who have to deal with the practical application of electricity in its different aspects.

"The Polar Planimeter." A manual. By Wm. Cox. Paper, pp. 20. New York: Keuffel & Esser Co.

NEW TRADE PUBLICATIONS.

The United States Mineral Wool Co. has just issued a new pamphlet entitled, "The Uses of Mineral Wool in Architecture, Car Building and Steam Engineering." The title expresses fully the nature of the contents, which will interest our readers, in view of the use of this material for insulating purposes. It is quite exhaustive in its discussions for a trade circular, and is fully illustrated.

The Sulzer-Vogt Machine Co. has just issued an attractive catalogue of their ice making and other machinery, which contains not only full technical information touching their system of refrigerating and ice making machinery, but also detail views of actual installations, and auxiliary appliances for handling ice in the factory, also a number of outline ground plans of ice making plants of all sizes, from three to six tons daily capacity, which of themselves will be found very useful by way of suggestion. A number of interior views of their works are also given.

THE DAVID BOYLE BUSINESS SOLD.

The Pennsylvania Iron Works Co., of Philadelphia, has concluded the purchase from the estate of the late David Boyle, of Chicago, of the entire ice machine business lately conducted by him. The Pennsylvania Iron Works Co. having possession of all drawings, patterns, etc., of the Boyle machines, and being thoroughly conversant with this line of business, they are prepared to make repairs, or to build new plants entire; and invite correspondence from parties contemplating the purchase of ice making or refrigerating machinery.

ICY ITEMS.

——Work began November 27 at Hellsboro, Tex., to sink a battery of deep wells for the ice factory.

——McCarthy Bros.' ice house at Norford, Mass., was burned December 18; loss, $3,000; no insurance.

——E. W. Morton has bought Nenney & Pardue's ice works at McKenney, Tex., and will add bottling works.

——The Consumers Ice Co., Chicago, are using the Illinois Metallic Packing Co.'s anti-friction metallic packing.

——The Pabst Brewing Co.'s ice plant at Guthrie, O. T., was burned December 22; loss, $20,000; it will be rebuilt.

——The Louisville Pipe Bending Co. recently shipped one lot of coils, containing one continuous length of over 800 feet.

——Arthur Oswald, of the Knickerbocker Ice Co., of Brooklyn, was thrown from a wagon November 27 and seriously injured.

——The Alaska Refrigerator Works, recently removed to Muskegon, Mich., are working 200 hands, an increase of forty this season.

——The Confectionery and Ice Co. at Leonard, Tex., will erect a bottling works, having ordered the machinery in November.

——Henri Reynaud and Adolphe Lapierre have formed a partnership as ice dealers at Montreal, Canada, under the name of Reynaud & Co.

——The Glenwood Ice Co., Galesburg, certified to an increase of capital stock to $75,000, and to an enlargement of the objects of the company.

——On November 26 the premises of the Arctic Freezing Co., 120 West street, New York, were damaged by fire to the extent of $8,000 to $10,000.

——The Pueblo (Colo.) Ice and Cold Storage Co. on January 1st resumes control of its retail tract which heretofore has been in the hands of other parties.

——The directors of the Corvallis Cannery and Ice Co., Corvallis, Ore., have increased the capital stock to $30,000, most of which has already been taken.

——The water famine in Brooklyn is so serious that the ice factories are frequently called on for ice to melt for water, both for drinking and lavatory purposes.

——The Oakland Hotel, Chicago, has now running a distilled-water plant, erected by the F. L. Galigher Co., which will supply the hotel with pure drinking water.

——The Swedish Honduras Fruit Co., has been incorporated at Chicago; capital stock, $25,000; incorporators, C. Thunstrom, Frank L. Malmstedt and J. P. Pibistrom.

——The El Paso Butter and Cheese Manufacturing Co. (Limited), has been incorporated at El Paso, Ill., capital stock, $5,500; incorporators, James A. Gilbert, A. D. Hopps and others.

——The Fayetteville Ice Co., and Electric Light Co., both largely owned by H. K. Brown, J. H. Holman and G. W. Morgan, have consolidated. The consolidated company will enlarge and improve both properties.

——F. L. Ellis & Co., Hopkinsville, Ky., write that the reported burning of their ice factory is an error, a building used for beer storage being burned, not their factory, which is still running with unimpaired facilities.

——The National Ammonia Co. recently shipped from Philadelphia to England, in one lot, to one consumer, 125 cylinders of anhydrous ammonia, containing 14,000 pounds. This is believed to be the largest single export order ever filled, and probably the largest order ever filled for any individual consumer in one shipment.

——An attempt, partially successful, was made December 22 to blow up the plant of the People's Ice Factory Co., at Birmingham, Ala. The perpetrator entered the building by a broken window, and placed a dynamite cartridge in the midst of the machinery. The explosion tore off the roof and damaged the machinery to the extent of several thousand dollars. No one was hurt.

——It has been the custom for the past five years for the various ice companies in Boston to turn over their spare horses to the fire department at this season, with permission to use them for their wintering. Recently about fifty of these horses were turned over. Horses which go to the fire house stables in the fall in poor condition always come out in the spring in perfect shape. This arrangement is perfect for both sides, as the fire department need extra horses in the winter, while the ice men want their extras in the warm weather.

——The Cochran-Oler Ice Co., of Baltimore, have leased the ice plants of F. W. Ayer & Co., in Brewer, Me., for a term of years, and will commence to operate there the coming winter. The company has a plant on the Kennebec river, where they harvest and ship annually 80,000 tons of ice, besides buying quite a number of thousand tons from other companies on that river. They have for several years had contracts with some of the ice companies on the Kennebec but deem it to their advantage to lease a plant on the Penobscot. The houses in Brewer will be filled to their utmost capacity and operations will begin early.

MINOR LEGAL NOTES.

——The Ely Coal, Ice and Bottling Co., of Ely, Minn., has made an assignment.

——The sheriff of New York, November 25, received an attachment for $18,287 against the Consolidated Ice Machine Co., of Chicago, in favor of the George F. Blake Manufacturing Co.

——The Paris Ice Manufacturing and Cold Storage Co., Paris, Ky., was sold by an officer of court, December 9, for $13,405 to John A. Hall, of Covington. The plant was erected one year ago by Geo. W. Seiler, at a cost of $40,000, who made an assignment in September last.

——A settlement has been effected in the case of Joseph Brindley, of East Dedham, Mass., against the People's Ice Co., of Boston and Dedham. Brindley was injured at the time the defendant's ice house fell, in 1885, at Wigwam Pond, Dedham. By the terms of the settlement he receives $4,500.

——The Missouri Refrigerator and Manufacturing Co., of St. Louis, has made an assignment to the Union Trust Co.; assets, $35,000; liabilities, $18,000. It is believed a satisfactory settlement will be made with the creditors, so that the company may resume business, which is valuable and profitable.

——The jury on the case of Geo. W. Hazel *v.* The Fostoria Cold Storage Co., Fostoria, Ohio, gave the plaintiff $3,500 damages. The suit was to recover for damages received while the plaintiff was working as a carpenter on buildings of the company January 25, 1889. The company was sued for $20,000. It is thought that the company will carry the case up on error.

——The Gate City Ice Co., Omaha, Neb., has sued the Crystal Ice Co., same place, for $2,500. The plaintiff alleges that the Crystal company agreed to furnish 1,500 tons of ice of a certain thickness and clearness, and that $500 was put up to bind the bargain. But when the Crystal began shipping the ice it was found not to be six inches thick, and not clear and wholesome.

——A petition signed by a majority of the trustees of the Monitor Ice Co., of Albany, N. Y., has been filed, asking for a dissolution of the concern. The capital stock is $60,000, which was paid for the property, plant, good will and business of a preceding company. The debts are $5,440.89, while the stock effects and other property are not valued at more than $3,559.90. Barrington King, of Albany, has been appointed temporary receiver.

——The Consolidated Ice Machine Co. estate, valued at $500,000, that has been subject to insolvency proceedings in the county court at Chicago, since October, 1890, will soon be settled. One of the largest creditors was John Featherstone's Sons Co., holding a claim for machinery furnished. December 10 this account was settled, and Judge Scales entered an order allowing the creditor $86,000. The assignee has on hand some $300,000 worth of contested claims due the insolvent, and he will ask to sell them at public auction.

——Edward L. Thomas, of Rochester, N. Y., has sued the Vacuum Oil Co. to recover $50,000 damages alleged to have been caused to his ice plant by refuse from the oil company's factory. He alleges that the water of the Genesee river, which flowed over and covered his premises, used to be of a pure and wholesome quality, and fit for the manufacture of ice. Now the refuse oils, naphtha, gasoline, tar, and other oils and filthy substances that flow from the oil factory pollute the water, he says, so that the ice produced is unfit for use, and unsalable.

——December 21 Judge Collins appointed Charles G. Perkins receiver for the Inter-State Cooling Co., of Chicago, upon a creditor's bill brought by James McGregor, to recover judgment for $1,153. The officers of the company state that the trouble is in their inability to collect accounts due, and that nearly all the liabilities have been paid by the officers personally, there not being to exceed $11,000 of indebtedness outside of these moneys advanced by them. The receiver will be able in a short time, it is said, to realize on the assets more than enough to pay all indebtedness.

——The decision of the United States supreme court in the New Orleans water works case will have a very important effect on nearly all the industries in that city. The state granted the New Orleans Water Works Co. a monopoly of selling river water in New Orleans. The company interpreted this to mean a monopoly to lay pipes to the river and drain water therefrom, and when the Southern Brewery and the ice works laid their pipes and secured river water in this way, the water works company interfered and sued them, claiming that they had no right to do so. This claim affected nearly every factory in New Orleans, for it cut them off from water, and the charges of the company supplying it were very high. Several other attempts have been made to secure a supply of water from other sources, and artesian wells were sunk with some success; but none of these plans gave complete satisfaction, and it seemed very hard that in a city like New Orleans, with the greatest river in the world flowing by its doors, its numerous factories should be prevented from availing themselves of an opportunity to get the water they needed. The decision, while it maintains the monopoly of the water works company to sell the river water, denies the monopoly of the river, and allows other companies to lay pipes there and supply themselves from it. A large number of them will do so, and will in this way secure the water they so greatly need. The decision will have the effect of concentrating the factories on the river front.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

·.· JANUARY, 1892 ·.·

SUBSCRIPTION PRICE, $2.00 PER ANNUM.
PAYABLE IN ADVANCE.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1892, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

INDEX TO ADVERTISERS.

Ainsley, Cochran & Co. ... 70
Alaska Refrigerator Co. ... 5
Am. Ice Machine Co., of N. Y. ... 71
Armstrong, Bro. & Co. ... 58
Armstrong Mfg. Co. ... 61
Arnold & Co. ... 57

Baragwanath, Wm., & Son. ... 54
Bartlett, Hayward & Co., Outside Back Cover.
Bird, F. W. & Son ... 56
Bird Paper Mfg. Co. ... 56
Black, A. W. ... 5
Blymyer Ice Machine Co. ... 72
Bodenstein, Henry ... 52
Bodenstein, J. G. & Co ... 53
Brandt, Randolph ... 53
Briggs, John N. ... 52
Buffalo Refrig. Machine Co. ... 73
Buhling Water Purifying Co. ... 62

Callahan, W. P. & Co. ... 73
Canton Steel Roofing Co. ... 54
Cardell, James D., & Co. ... 65
Case Refrig. Machine Co. ... 68
Castle Ice Machinery Co. ... 68
Central Ice Co., The ... 52
Chapman Valve Mfg. Co. ... 50
Clapp, B. P., Ammonia Co. ... 7
Cleveland Anhydr's Am. Works. ... 7
Columbus Iron Works Co. ... 66
Conway, P. J. & Co. ... 58
Cook, A. D ... 9
Cook, E. H., Co. ... 49
Craft Refrigerating Machine Co ... 69
Crane Co. ... 50
Curtis, J. Walton ... 52

Dalzell, Jas. & Son ... 58
Davis & Rankin B. & M. Co. ... 51
Dean Bros. ... 8
Deane Steam Pump Co. ... 9
De La Vergne Refrig. Mach. Co. ... 78
Directory of Ice Factories, Ice Dealers & Cold Storage Houses. ... 52
Dodge, B. G. ... 57
Downie Bros. & Nevin ... 50
Dunlevy Sheet Iron Works ... 54

Electric Pipe Bending Co. ... 65
Epping, Carpenter & Co. ... 9
Excelsior Ice & Cold Storage Co. ... 52

Farrell & Rempe ... 66
Featherstone's Sons, John ... 77
Forest City Packing Co. ... 53
Foster Pump Works ... 9
Frick Co. ... 80, 81

Galigher, The F. L. Co. ... 51
Garlock Packing Co. ... 53
Georgia Ice Co. ... 52
Gerlach, Peter, & Co. ... 52
Gifford Bros. ... 52
Goodrich, B. F., Co. ... 60
Gordon Steam Pump Co. ... 4
Grand Rapids Refrig. Co., The ... 6
Graver, Wm. ... 51

Harrisburg Pipe Bend. Co., Ltd. ... 64
Heerdegen & Schnee ... 60
Hercules Iron Works ... 3
Hendrick Mfg. Co., Ltd. ... 68
Hilpert & Chandler ... 50
Herf & Frerichs Chemical Co. ... 10
Hoppes Mfg. Co. ... 50

Illinois Metallic Pkg. Co. ... 50
Isbell-Porter Co. ... 67
I. & R. Binder ... 50

Jackson Refrigerator Co. ... 6
Jewell, O. H., Filter Co. ... 62
Johnson, McCarthy & Johnson ... 69

Kendall, Edward & Sons ... 61
Keystone Chemical Co. ... 55
Krausch Co., The Theodore ... 67
Krebs, H. J. ... 76
Kiechler Mfg. Co. ... 55

Laidlaw & Dunn Co., The ... 8
Lansing Iron and Engine Works. ... 61
Lawson, Enoch ... 52
Loomis Imp. Filter Co. ... 62
Louisville Pipe Bending Co. ... 68

McCarthy & Son, James ... 52
McCray Refrig. and C. S. Co. ... 4
Mackolite Plaster Board Co. ... 51
Maritzen, Aug ... 60
Mason Regulator Co. ... 62
Merchant & Co ... 58
Miami Valley Boiler Co. ... 61
Moyer, J. W. ... 61
Mustard, J. C. ... 76

National Am. Co., Outside Back Cover.
New Orleans Ice Mfg. Co. ... 52
N. Y. Coal Tar Chemical Co. ... 6
Northern Refrigerator Co. ... 6
Northwest C. S. and Ice Co. ... 52
Nubian Iron Enamel Co., The ... 49

Otto Gas Engine Works ... 55

Pennsylvania Iron Works Co. ... 69
Phosphor Bronze Sm'lt'g Co., Ltd 60
Pictet Ice Works, The ... 52
Pontifex Ice Machine Co., The ... 68
Pusey, Lea ... 7

Queen City O. and W. Mfg. Co ... 60

Reading Iron Co. ... 63
Reliance Gauge Co. ... 50
Rosengarten & Sons ... 7

Samson Steam Forge Co. ... 63
Sauls Bros ... 54
Seibel-Suessdorf C. & I. Mfg. Co. ... 54
Severn & Caven ... 7
Shipman Engine Co. ... 55
Simpkin, Hillyer & Co ... 74
Smith & Vaile Co. ... 4
Southern Ice Machine Co. ... 75
Standard Ice Co ... 52
Standard Paint Co. ... 56
Standard Thermometer Co. ... 8, 53
Stilwell & Bierce Mfg. Co. ... 53
Stromberg, Allen & Co., Outside Back Cover.
Swanitz, A. W. ... 50

U. S. Mineral Wool Co ... 56

Valley Pump Co. ... 8
Van Winkle Gin and Mach. Co. ... 71
Vulcan Iron Works, The ... 69

Wainwright Mfg. Co., of Mass. ... 7
Wants, and For Sale, Etc ... 49
Washington Market Co. ... 52
Watson, H. F., Co. ... 56
Weisel & Vilter Mfg. Co. ... 71
Weiskopf, A. ... 53
Westerlin & Campbell ... 54
Western Ice Machine Co. ... 70
Western Mineral Wool Co. ... 56
Whitehall E. and P. I. Mach. Co. ... 79
Wilson-Snyder Co. ... 82
Wingate & Mell ... 54
Wolf, Otto C. ... Inside Front Cover
Wolf, The Fred W. Co. ... 10
Wood, Wm. T., & Co. ... 52
Woolford, Geo. ... 60

York Mfg. Co., Inside of Back Cover

BOUND VOLUMES.

The publishers of ICE AND REFRIGERATION have on hand a few complete bound sets of Vol. I of this paper, which will be sold at $5 per copy, bound in half Morocco, or $4 per volume, bound in half leather. Those of our readers who wish to bind their own copies may send them to this office, where they will be bound in half Morocco at $4 per volume, or $3 in half leather, the sender paying charges (express) both ways. The publishers can no longer furnish complete sets of back numbers, the editions for several months having been entirely exhausted, while the number of bound sets at above prices is limited to a few dozen copies, so that those who desire complete sets must order them at once. This is the only way that a complete file of the paper can ever be obtained.

OUR "WANT" COLUMN.

The attention of the reader is called to our "Want and for Sale" column, which for general usefulness to our patrons can hardly be overestimated as a medium for obtaining help or situations, or for buying or selling second-hand machinery. ICE AND REFRIGERATION has now so large a circulation in all parts of the country, and has become so thoroughly and completely recognized as the only organ *par excellence* for communicating with individuals or firms comprising the ice and refrigerating industry of America—not to say the world, this being the only journal of its kind in the world, in any language—that an "ad-let" inserted in that column is almost certain to reach the person desired and to accomplish the purpose of the advertiser. The terms for such advertisements are low; and we can advise our readers to use the column whenever they have wants to meet which can reasonably be expected to be filled by such method.

AFTER SIX MONTHS.

The gentlemen whose esteemed favors are mentioned below have all been readers of ICE AND REFRIGERATION since its establishment six months ago. What they have to say of the impression the paper has made upon them during that time is the more gratifying to the editors and publishers because it is a judgment expressed after receiving and reading a series of numbers, and not an evidence of a gratification induced by the finding of something of interest in a single number. The publishers have aimed to make every number perfect in itself, and that each succeeding one should be equal to the best that had preceded it; and it is a source of satisfaction to know that the readers of the six numbers thus far issued are pleased with the work done by us as a whole.

[BOWLING GREEN ICE CO., Bowling Green, Ky.]

We most cheerfully send you our check for ICE AND REFRIGERATION one year. It has been worth many dollars to us. No ice factory can afford to do without it.

[PASCAGOULA ICE CO., Scranton, Miss.]

We inclose $2 for ICE AND REFRIGERATION one year. One piece of information alone, gleaned from the sample copy sent us, saved us the subscription price many times over; and we do not see how any one in the ice business can afford to be without your publication.

[JOHN H. WAUTZ, Engineer THOMASVILLE ICE CO., Thomasville, Ga.]

You will find inclosed $2 for subscription to ICE AND REFRIGERATION. I like the paper "all O. K." It has been "a dandy" for me. I am engineer of ice machines, and I get lots of information from it regarding making ice. Many thanks for the good advice I get from it.

[WILLIAMS & WATSON, Oklahoma City, O. T.]

Inclosed find $2 for subscription to ICE AND REFRIGERATION. We get much valuable information from it, and are well pleased with the paper. You are doing a good work.

[J. J. JACKSON, with CONSOLIDATED ICE CO., Shreveport, La.]

I am greatly pleased with ICE AND REFRIGERATION: would not be without it. Much success to you in the future.

[ARTHUR SLAGLE, London, Ohio.]

Please find check for subscription; and send that valuable paper right along.

[MICHIGAN AMMONIA WORKS, Detroit, Mich.]

We take pleasure in accompanying our check for subscription to ICE AND REFRIGERATION with a word of praise for the excellent work you have submitted to your readers; and wish you all success.

[PURE ICE AND COLD STORAGE CO., Springfield, Ill.]

We hand you herewith check for subscription. We are *sure* we have secured full value for the money. We enjoy the paper very much.

[C. J. MONTGOMERY, Mngr. and Sec'y, NATCHEZ ICE CO., Natchez, Miss.]

We are very much pleased with ICE AND REFRIGERATION, as it is something that has been needed for some time.

[F. L. ELLIS & CO., Hopkinsville, Ky.]

Inclosed find $2 in payment for subscription one year. We are much pleased with your paper, and you have our best wishes for your success.

[FORT PAYNE ICE AND STORAGE CO., Fort Payne, Ala.]

Inclosed find $2 for our subscription. We find ICE AND REFRIGERATION one of the most useful that we can study, and to be without it would be like being without one's most useful companion. We wish you every success in your good and beneficial work.

[J. L. BYE, Tacoma, Wash.]

Inclosed find $2 for a year's subscription to ICE AND REFRIGERATION. To say the least, I am very much pleased with "I. AND R.," as it is some satisfaction to sit down and read a paper that treats everything fairly and squarely, and it certainly is a very good educator for the trade, and its readers in general.

[CRYSTAL ICE CO., Richmond, Va.]

We herewith hand you postal note for $2 to pay one year's subscription to your valuable paper, which we have been receiving since the first issue. We are greatly pleased with ICE AND REFRIGERATION, and glad to see that the much abused ice manufacturer has such a good champion. You show much more charity toward the natural ice dealer than their special organ shows toward the ice manufacturer, although that journal has been less severe on manufactured ice since the proprietors bought a machine, and have been handling ice manufactured by others. The abuse of manufactured ice is now carried on by their correspondents, instead of by the editor.

With regard to this last, we would like to add that ICE AND REFRIGERATION was designed to be a champion of the ice and refrigeration industries, occupying a positively independent position, with "no axes to grind" of any sort or description; and that independent position it still occupies, and always will. Its editors and publishers have no interest in any ice or refrigeration business, directly or indirectly, nor in any line of machinery of any sort or description. Every word, line or paragraph printed in this journal is designed to instruct or interest the whole trade, and has no other object. An "armed neutrality" will at all times be maintained, but no fact that is of value will ever be withheld for fear individuals may be affected unfavorably, provided the general good is conserved by the publication of the truth.

Though the editors of ICE AND REFRIGERATION cannot fail to take "judicial notice" of the fact that a "state of belligerancy" exists between the dealers in natural and in manufactured ice—that "grim-visaged war has *not* smoothed his wrinkled front" nevertheless they do not admit or recognize that a *causus belli* rightfully or naturally exists.

Ice is ice—nothing more, nothing less, no matter whether it comes from the freezing tank of the factory or from the rivers or ponds that are frozen by Mother Nature. The use by the public of the one or the other depends entirely on the cost delivered to the consumer. He is blind, indeed, who does not see that all industrial forces of the age are working toward a cheapening of the cost of production and distribution. The producer who fails to recognize this fact cannot escape ultimate financial annihilation—it is as inevitable as death itself. Therefore, however, in certain localities, the conditions for this immediate present obtain, the whole problem must ultimately turn on the simple question of cost. Wherever now natural ice can be harvested and sold to the consumer at a less price, with profit added, than ice can be manufactured and sold for at a profit, it requires no wise man to point out the folly of erecting an ice machine: and wherever those conditions continue to prevail, it is safe to say no ice machine will ever make ice. On the other hand, wherever ice can be made and sold with a profit more cheaply than ice can be harvested, stored and sold, there the ice machine will sooner or later find its place. Every thinking man must recognize the truth of these statements. It is a "fool's errand" for a man to attempt to make ice by machinery where nature can supply it cheaper; it is also a fool's folly for a man to suppose he can prevent the use of the ice machine wherever the latter can supply the consumer and earn a profit at a price which gives the dealer in natural ice no profit.

The whole problem is, therefore, reduced to a simple question of a matter of pecuniary profit: it is the only point at issue. Whether the machine ice supplants the nature-made ice, or *vice versa*, depends upon that point only; and the dealer in either product who ignores that fact does so at his peril.

This, then, is the position of ICE AND REFRIGERATION: Absolute neutrality as between the two branches of the one industry, and the publication of all such facts of news, comment or scientific discovery as will be of value to the whole trade. The dealer in natural ice cannot, as a business man, afford to remain in ignorance of what is going on in the manufactured ice industry; for in a business way this is as suicidal as the action of the ostrich which when pursued throws itself upon the earth and hiding its head under its own wing imagines it is safely hidden from view of its enemies. The same remark may be made of the ice manufacturer also. It is the business and purpose of ICE AND REFRIGERATION to keep both parties fully informed.

While, therefore, we do not assume to ourselves any special credit for maintaining a strict neutrality, we do feel gratified to know that such neutrality is a matter of congratulatory comment on the part of our readers.

A COMPANY in Chicago is preparing to manufacture a refrigerine salt, a newly discovered compound, which is applicable to refrigerator boxes, cold boxes in market stalls and groceries; also for cars of fruit in transit, for household purposes, etc. It is said to be much cheaper than ice and, much more convenient.—*Cal. Fruit Grower.*

Our esteemed contemporary is far, far removed from the busy turmoil of the "effete east"; but we had no idea he was so deeply secluded as never to have heard of the fate of Smith and his "refrigerine." Perhaps the news will reach the coast in 1900.

ANSWERS TO CORRESPONDENTS.

ELECTICITY IN THE PRODUCTION OF COLD—ABSOLUTE TEMPERATURE—HARD WATER IN BOILERS—SECOND-HAND MACHINERY—TO OBTAIN DRY COLD AIR.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: Do you know of any way in which electricity is used in the production of cold, or of a method by which electricity could be made serviceable for that purpose? Of course, I am aware that a dynamo may be used to work a compressor, or other mechanical device for the production of cold, but I have reference to a more direct way, of which, it strikes me, mention was made some time ago. F. P.

ANSWER.—We do not remember of having heard of a direct way of converting electricity into cold, unless it be the following fact which is generally alluded to in dissertations on thermo-electricity, viz.: If an electric current is conducted through a rod made by soldering together two different metals, notably a rod of antimony to a rod of bismuth, the place where the metals are soldered together becomes hot when the current flows in one direction, and cold when the current flows in the opposite direction. If the current be strong enough, small quantities of water, contained in a cavity, where the metals are joined together, may be changed into ice.

To the Editor: Will you please publish in your next issue a plain definition of what is meant by absolute temperature? CH. B.

ANSWER.—The absolute temperature of a body is its temperature expressed in degrees, counting upward from the absolute zero of temperature. The absolute zero of temperature is about 460 degrees below the zero of the Fahrenheit scale. Its existence cannot or at least has never been experimentally demonstrated. It has been established by inference and calculation as that temperature at which all bodies have lost their expansive power, at which the volume of a perfect gaseous body would shrink to nothing, as it were, and at which the motions of the molecules or atoms of a body have come to an absolute rest. The nearest experimental approach to such a low temperature has been obtained by the volatilization of some liquefied gases, notably oxygen and nitrogen, temperatures of —370° F. having been produced thereby.

To the Editor: The water which we are using in our boiler is very hard, and causes much scale. We have been recommended a so-called boiler purger, but are afraid that its use may interfere with the purity of our distilled water for ice making which we derive from that source. H. P. S.

ANSWER.—If you had stated the composition of the material in question, or had sent us a sample of same, we could have given you a more definite answer than we are able under the circumstances. Generally speaking, if the boiler purger is of a purely saline character, not containing or capable of discharging any volatile matter on being heated, it will not damage the character of the distilled water, especially if the bad effects of possible priming of the boiler are guarded against.

To the Editor: Do you consider it safe to buy a second-hand ice machine? and can you give us any information as to how to guard against being imposed upon in a deal of this kind? S. A.

ANSWER.—There is, we judge, little difference in this respect, between a second-hand ice machine and other second-hand machinery, unless it be that the failure of an ice machine at an unexpected moment may be accompanied by especially serious consequences. If you cannot satisfy yourselves by your own inspection and by the testimony of disinterested parties that the machine is what you want it to be, or if you cannot obtain a sufficient guarantee from the present owner, you should have the machine inspected or tested by a competent expert before concluding the bargain.

To the Editor: I am interested in learning what can be done in the way of drying air by refrigeration. The question has been somewhat ventilated in ICE AND REFRIGERATION, but not to my entire satisfaction, one correspondent holding that it can be done better by artificial refrigeration than by ice, and another holding that the extreme limit of drying air is to the point of saturation at the temperature to which it is refrigerated. There seems to be something contradictory in this, as air saturated with moisture cannot be considered as dried in one sense of the word. CL. K.

ANSWER.—The statements referred to are correct as far as they go, but they do not touch that portion of the question which you probably have reference to. If we understand you correctly, you want to produce cold air of a dryer condition than that represented by the saturated state. This cannot be done by direct refrigeration, but it can be done indirectly by this agent. It may be accomplished by making the air the vehicle for the transfer of refrigeration by cooling the same outside of the rooms to be refrigerated to a temperature much below that of these rooms. The temperature of the air so refrigerated, on entering the rooms, increases and thereby becomes dryer and capable of absorbing more moisture before the point of saturation at that temperature is reached. The air in such a case may be used over again in a circuitous process.

A TELEGRAM of December 25 from Augusta, Me., says that the continued mild weather is creating no little interest among the ice dealers and speculators, who see money in a short ice crop. They are again watching the Hudson with a vigilant eye, and hoping that the river will not freeze thick enough for harvesting. There are now only about 50,000 tons of ice on the Kennebec river, the quantity being less than for many years at the opening of the harvesting season.



ABOUT THE SAME THING.

"By George!" said Mr. Polar Bear, as he gazed at the borealis, "it's a corker!"

"No," said Mrs. Polar Bear, "it is not a corker. It's that new paper!"

THEORY AND PRACTICE.

HOW TO MEASURE THE QUANTITY OF ICE A COMPRESSOR WILL PRODUCE—A CRITICISM OF THE ANSWER MADE LAST MONTH—A REPLY TO THE CRITIC.

By George Richmond.

I beg to call your attention to the answer to T. A. S. in the December number of Ice and Refrigeration, in which I think you have unwittingly done injustice to two classes of your readers, namely, the ice machine makers and the scientists.

In the interest of that harmony which ought to exist between theory and practice and their respective exponents, I would ask you either to publish this or make the correction in your own manner.

T. A. S. has probably knowledge of a machine of the dimensions given by him; and when he figures out the amount of refrigeration he really gets, he will come to one of two conclusions, or, perhaps, both: That theory is away off, or that builders are further off still.

The fact is that T. A. S. should have been informed that no estimate whatever could be made without information as to the temperatures of his condenser and refrigerator, or, what amounts to the same thing, the high and return pressures.

Instead of this, a calculation is made on a basis of conditions which never have existed, and never will exist, in any refrigeration plant; and the result thus obtained is referred to as *the* so-called theoretical amount, leaving it to be inferred that theory calls for 132 tons of refrigeration per day from a double-acting compressor, 12″ × 24″, making seventy revolutions per minute.

There can be no objection to dividing the latent heat of ammonia into two parts; namely, the internal or molecular work, and the external or expansive; further than that it is apt to be misleading—as in the present case—where the external work is spoken of as the work of the compressor, whereas it represents work done on the compressor, and moreover the number 540, which is the total latent heat, is written in the place of the internal latent heat, which is 488, making an error of more than 10 per cent.

Moreover, it is assumed that this is all effective for refrigeration purposes, whereas in any continuous process the liquid ammonia is passed from the condenser to the refrigerator, and its first work is to cool itself. The exact amount thus to be deducted cannot be stated without a knowledge of the two temperatures above referred to, but in practice it rarely amounts to less than 10 per cent.

Finally, the return pressure, 55.2, or 40.5 on the gauge, does not fairly represent actual practice; indeed it is safe to say that not one machine in a hundred is run at that pressure.

If we assume that the condenser temperature is 80°, corresponding to a gauge pressure of 140 pounds, the following table answers the queries of T. A. S. for a range of temperature in the expansion coils which might occur in practice.

Back pressure (gauge)	39.7	33	28.2	24	19.5	15.7
Temperature in expansion coils	25	20	15	10	5	0
Weight of cubic foot of ammonia	.19	.172	.155	.137	.124	.111
Volume of one pound of "	5.4	5.82	6.46	7.2	8	9
Net cooling effect of one pound amm.	3.4	3.39	3.38	3.37	3.36	3.35
Maximum capacity	103	93	83	74	66	59
Fair capacity	77	69	62	55	49	44

The first four of these are from tables of the properties of ammonia: the fifth is the net cooling effect of one pound of ammonia obtained by subtracting the heat carried into the refrigerator (from the condenser) from the total latent heat, and dividing by 142.

The sixth line is obtained by multiplying the volume passed through the compressor in twenty-four hours by the weight of a cubic foot in line three, and by the net cooling effect as above, and reducing to tons.

The seventh line is obtained by reducing the sixth 25 per cent. And this is the amount theory calls for; or, to be perfectly correct, it asserts that the production *must* be less than that given in the sixth line, and that 25 per cent fairly represents the reduction on account of physical conditions, the effect of which cannot be accurately foretold, for the sixth column was calculated on the supposition that –

(1.) The ammonia is drawn though a series of pipes and through valves, and finally arrives in the cylinder at the same pressure it had in the expansion coils.

(2.) That the ammonia is at the same temperature in the pump as in the expansion coils, whereas, in passing though a hot engine room and into a hot pump, it is usually superheated.

(3.) That absolutely no leakage takes place, either through the piston or valves.

(4.) That there is absolutely no clearance.

Now, theory recognizes that these are all physical impossibilities, and have to be allowed for, although the exact amount cannot be foretold. And it is at this point that theory and practice join hands,—practice formulating the data for completing the theory A fair representative case would be that of the fourth column with a return pressure of 24°; in which case Nevey says to T. A. S. that he may be well satisfied with anything between seventy-four and fifty-five tons, the former of which he cannot possibly get; the latter, with first-class workmanship, he may expect to obtain under the assumed conditions.

The results also show that under any practical conditions five cubic feet to the pound will lead all astray; under most usual circumstances with pressures between 30 and 15, it will vary from six to nine cubic feet.

Also, that the refrigerating effect of one pound of ammonia is *never* equivalent to four pounds of ice in any apparatus running continuously, and that about three and one fourth pounds is the theoretical amount for a large range of practical conditions.

I must apologize for taking up so much of your space. I may plead, however, in justification, that the principle involved is one of the utmost importance to all engaged in the business; and I will conclude with the suggestion that you should call for an expression of opinion as to what physical conditions should be agreed upon as a fair basis for calculating the capacity of a machine. As my own contribution, I would propose a back pressure of about twenty-five pounds, and a high pressure of 150 pounds. It is possible by figuring on widely varying conditions to get any result called for, and this is done sometimes in good faith and frequently not; but in any case the result is to destroy confidence, from which no one benefits but promoters of wild-cat schemes.

A REPLY TO THE ABOVE.

While we gladly give voice to the interesting expositions of our esteemed correspondent, we cannot help making a few remarks regarding his criticism. Our

answer to the question of T. A. S. was made on purely theoretical bases, and on ideal conditions, as plainly appears from the same, and ample reference is made therein for loss sustained in practical working. Our correspondent insists that we should not have attempted to answer the question without having obtained more particulars from questioner, yet he should consider that in publishing a journal expediency, although not our motto, has at times to be consulted in order to bring matters before our constituency without loss of time. We are the more inclined to pursue this course, as many subjects which must be disposed of on short notice cannot always receive at our hands the exhaustive attention which we might wish to give them, and, moreover, we are fully aware that, like all individual knowledge and experience, ours must necessarily be limited as compared with that of the trade at large, on the coöperation of which we largely rely. So in this case, rather than miss the issue, we assumed back pressure of 55.2, and, although such a pressure may not occur in practice "once in a hundred cases," yet it was in perfect consistency with the treatment of an ideal process, to which our figures were calculated to refer. But, as it is, the beam is always in our neighbor's eye; so in this case, our esteemed correspondent, while taking us to task for having undertaken to answer the said question without further particulars from the questioner, himself takes the privilege to answer them (both on a theoretical and practical basis) without such particulars, in much the same manner, by assuming, the same as we did, other but different back pressures as governing the question. We mention this as a refreshing incident, not that we find fault with this course; on the contrary, we are always willing to give our correspondents a little more latitude than we would claim ourselves, the more so in this case, as our correspondent's communication contains additional information of very considerable practical value and interest in regard to the actual yield of refrigerating capacity. As to the back pressures assumed, it is claimed that they come nearer to those generally obtaining in practical working. They certainly are farther removed from the ideal condition on which a compressor would give the most favorable results, than the back pressure assumed in our answer. So much as to back pressure. This also disposes of our correspondent's criticism in regard to the number of cubic feet of gas contained in one pound of ammonia, and also of the equivalent of refrigerating capacity of one pound of ammonia, as these qualities change quantitatively, as a matter of course, with the back pressure assumed. As our figures were correct for the back pressure assumed by us, they must necessarily be incorrect for the back pressures assumed by Mr. Richmond.

In regard to the rule employed in the calculation, we see no reason to change that either, with the exception of that item relating to the work done by the expanding ammonia through the compressor, which should have been omitted in this connection, although it forms a considerable item in lessening the work of the compressor.

As to the latent heat, there is no doubt in our mind that the figure 540 is the correct one, and not 488, as recommended by our correspondent, since the whole of the latent heat (internal as well as external work) comes into play in the refrigerator. This position is also taken by Wood, who, on page 340 of the fourth edition of his work on Thermodynamics, in speaking of compressor capacity, gives the following relation:

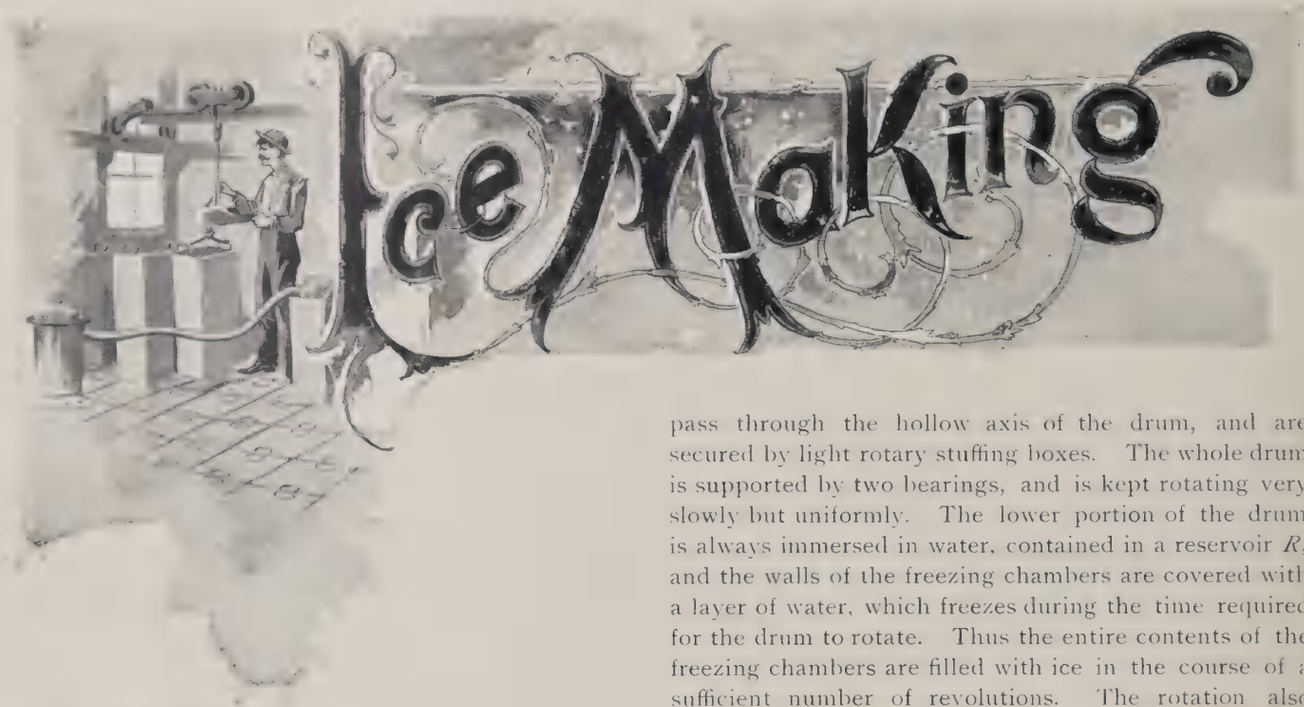
$$q = \frac{N\ V}{v} h_2$$

in which q is the number of thermal units abstracted per minute; N the number of strokes, V the volume swept over by piston, and h_2 the latent heat of ammonia, *i. e.*, the total latent heat (540 in our case) and not 488 (only internal heat). This formula also disposes of the objection made by our correspondent in regard to the amount of refrigeration needed by the ammonia to cool itself on entering the refrigerator. This item was not deducted by us, and is not deducted in above formula, neither do we think it ought to be in a theoretical calculation, as it represents refrigeration actually taking place in the refrigerating tank. True, it is not made available, but so are other items which enter into a theoretical calculation; indeed, it is for this reason it is called theoretical in contradistinction to actual yield.

The above formula of Wood, agreeable to our former calculation, gives a maximum theoretical refrigeration of 1,425,600 calories per hour, or nearly 120 tons of refrigeration in twenty-four hours, which figure is nearer to our original figure (132) than to that of Mr. Richmond, who gives 103 as the maximum theoretical effect of a compressor as described. As we have done in the original answer, we repeat again that our calculations represent theoretical results supposed to be obtained under abstract ideal conditions, and that like all such results, valuable as they always are, they must be reduced by constants found by experience and practice, and without such, they are not comparable with the practical capacities as calculated by Mr. Richmond, nor were they intended to be so compared.

As to Mr. R.'s suggestion to solicit expressions of the fraternity, with a view to establishing a uniform basis for calculations of this kind, we think it a very good one, and it will have our hearty coöperation; yet, while we are not unmindful of the value of the recommendations made by our correspondent in this respect, and while we shall cheerfully abide by what may be generally adopted in this direction, we may still be allowed to express ourselves in favor of a basis for theoretical calculation embodying the ideal conditions assumed in our answer, and also embodied in Wood's formula, as the most complete and convenient. From the results so obtained an agreed percentage (arrived at by compromise and otherwise) might be deducted to arrive at a so-called practical yield or capacity under various circumstances. As for practical calculations, the back pressure proposed (25 lbs.) may represent a fair average of existing conditions, but there are wide ranges above and below, and for this reason we think a table, somewhat similar to that presented by Mr. Richmond, but covering wider ranges of differences in working conditions, would be the most serviceable for practical and every-day use. Such a table would be all the more valuable if it could be made to embody such recommendations and propositions as are likely to come in in response to Mr. Richmond's invitation.

H. A. Beard, of Chicago, is prospecting for locations for ice factories. He has made a proposition to Joliet, Ill., and, it is reported, will build three factories in California during the present winter.



[*Written for* ICE AND REFRIGERATION.]

APPARATUS FOR MAKING CLEAR ICE.

ATTEMPTS TO MAKE CLEAR ICE WITHOUT PREVIOUS TREATMENT OF THE WATER—THE LINDE AUTOMATIC ICE GENERATOR —THE OSENBRUECK APPARATUS.

In order to avoid labor and to produce clear ice without previous treatment of the water, if possible, a number of devices have been constructed which answer this purpose to a greater or lesser degree. Herewith are shown a few of these devices. One of them, the Linde ice generator, is shown in Figs. 1 and 2. It is mechanical throughout, calculated to perform the production of ice automatically. The time used for filling and emptying the freezing chambers is to be avoided in this manner:

The freezing cells or chambers are placed radially in the circumference of a drum *T*, and are packed or

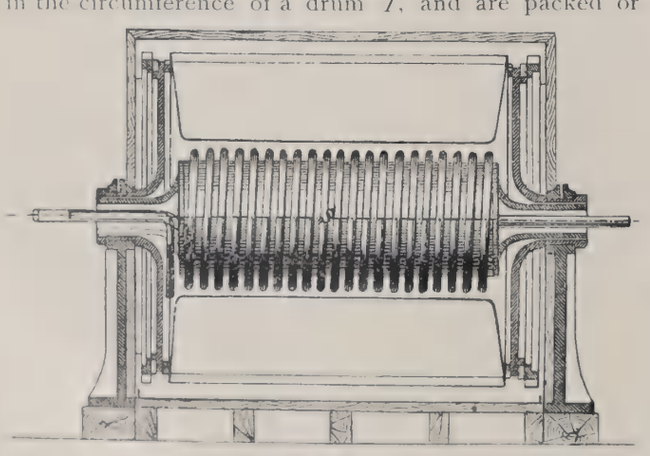


FIG. 1.

sealed hermetically toward the interior of the drum. The bottoms or ends of the drums, which are screwed on hermetically, are provided with hollow axles. In the interior of the drum is placed the vaporizer of the ice machine, in the shape of a horizontal spiral tube *S* and surrounded by a liquid which will not freeze, a solution of salt or of chloride of calcium. The ends of ammonia expansion tubes, as well as an opening to fill in the brine, pass through the hollow axis of the drum, and are secured by light rotary stuffing boxes. The whole drum is supported by two bearings, and is kept rotating very slowly but uniformly. The lower portion of the drum is always immersed in water, contained in a reservoir *R*, and the walls of the freezing chambers are covered with a layer of water, which freezes during the time required for the drum to rotate. Thus the entire contents of the freezing chambers are filled with ice in the course of a sufficient number of revolutions. The rotation also

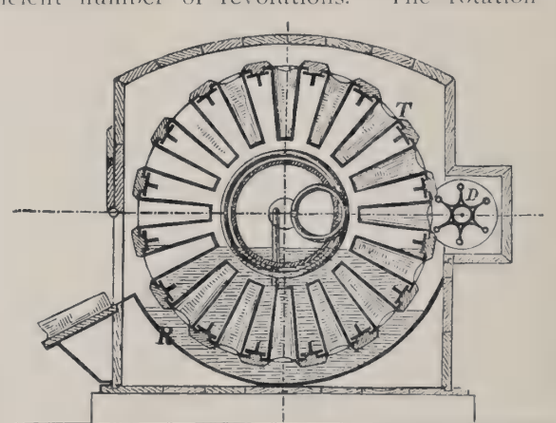


FIG. 2.

causes a lively motion of the salt brine, in the interior of the drum, thus effecting an active exchange of temperature between the spiral and the freezing chambers.

When the freezing chambers have been filled with ice in this manner, which takes about eight hours, the ice is loosened from the walls of the chambers by withdrawing the cold brine from the drum, by means of a pump, substituting therefor one slightly warmed. A portion of the ice, however, always freezes over the edges of the chambers, and in order to loosen the block of ice to perfection, this edge must be cut away, which is done perfectly by means of a peculiarly constructed steam cutter *D*, Fig. 2. The ice blocks thus perfectly disconnected, fall directly without any further assistance through the opened door in the box encasing the drum, on a wagon or other vehicle. In this manner the whole drum, containing in all about seventy-two ice blocks, weighing about 2,500 pounds, is emptied in a very short time, and without any manual labor.

Another apparatus for the production of clear ice has been patented in Germany by Messrs. Osenbrueck & Co. It is illustrated in the accompanying diagrams, Figs. 3 and 4. The means to prevent the air, which is contained in the water, from remaining in the ice, consists in a violent motion within the freezing chambers, in order to tear the small ice bubbles from the surface of the ice, as it were. Thus their being inclosed in the ice may be prevented.

The motion of the water in the freezing cells, or chambers, is brought about by different means. In the appa-

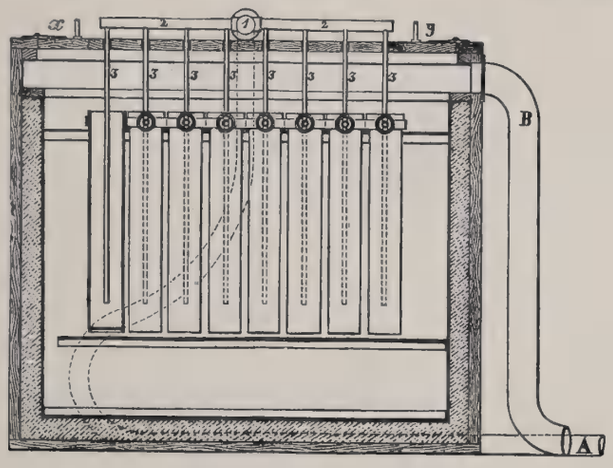


FIG. 3.

ratus illustrated in Figs. 3 and 4 it is effected by the injections of cold air near the bottom of the freezing cells. The cells are placed in rows, forming sections, which may be moved about on rollers resting on the rails in the generators, so that at one end of the generator the freezing chambers are introduced, while at the other end they are removed, the whole series of sections being in motion whenever a new section is introduced. Fig. 3 shows a longitudinal section of the generator, without the mechanical attachments for moving the sections. Fig. 4 shows the device for the introduction of air for a generator with thirty-two freezing cells. This device rests on the wooden lid of the generator, and its main pipe 1 is, by means of a rubber hose *A*, connected with a Root blower not shown in drawing. With the main pipe 1 the branches 2 are connected, and from these issue the pipes 3, one for each of the freezing cells (see Fig. 3 and 4). The lower ends of these pipes terminate at some distance from the bottom of the freezing cell, and they pass rather tightly through the wooden lid of the generator. Those portions of the pipes which are outside of the blower, as well as the blower, are protected by bad conductors of heat. The air which is blown into the water of the cells through the pipes 3 causes considerable commotion in the same, thus achieving the desired object. The cold air, disengaged from the water, collects in the upper part of the generator, whence it is aspirated through the pipe *B* by the blower, to commence the same over again. The introduction of outside heat is prevented thereby. The freezing of the ice blocks is not carried to such an extent as to freeze in the pipes 3. If any section of cells containing the ready ice is to be removed, the whole system of pipes is lifted, by means of a mechanical arrangement, high enough to permit the cells to pass free below them. For this reason the pipe *B* is made of rubber, and the blower is stopped meanwhile.

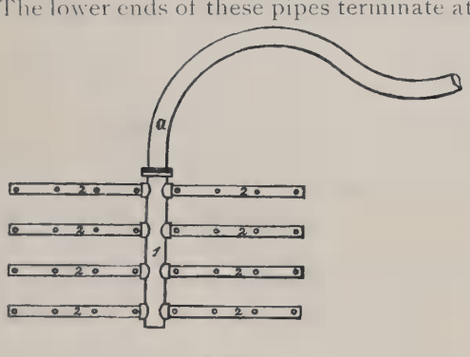


FIG. 4.

(TO BE CONTINUED.)

[*Written for* ICE AND REFRIGERATION.]

PIONEER ICE MAKING.

ICE MAKING IN NEW ORLEANS IN THE SIXTIES—DR. ALBRECHT THE FIRST TO PROPOSE BOILING WATER TO OBTAIN CLEAR ICE—EARLY MECHANICAL REFRIGERATION.

BY F. V. DE COPPET.



THE rapid strides made in the manufacture of the various systems of ice and refrigerating machines in the past twenty-two years have given a great impetus to several improvements brought in their construction, as well as in the methods of producing artificial cold and ice. As it may be interesting for those in the business to learn of the first steps taken to manufacture ice in this city [New Orleans], I will state my experience:

In 1868 the Louisiana Ice Manufacturing Co. erected six 10-ton Carré absorption ice making machines, which were constructed at Gretna, La., opposite New Orleans, by Mr. Sylvester Bennett, from plans furnished by M. Carré. The retorts, or generators, were made of heavy, double-riveted boiler iron, and were heated by direct fire. The freezing tanks were made in the shape of a cross, each tank being about 7 ft.×6×4 ft. deep. The cans holding the water to be frozen were 2½-in.×10×30 in. deep, and, when frozen, weighed twenty-five pounds each. Five blocks were placed upon each other, making a block of 100 pounds.

This ice was not clear nor very solid, and was made of filtered river water, its color resembling stained alabaster. The public didn't take to it kindly. The froth, or foam, arising from the surface of the water containing pieces of this melted ice, gave rise to several objections, the most serious and common one being that the ice contained ammonia and was unwholesome.

This objection, although not real, caused the Louisiana Ice Co. to employ a chemist to find, if possible, a remedy, selecting Dr. Jos. Albrecht, of the United States mint, of New Orleans, to whom, I believe, the credit is due of having first given the idea of making transparent ice, his advice being to boil the water before it was put in the cans, so as to drive off the air and gases it contained. The experiments in this direction, in which the writer assisted, were successful, subsequent experiments being made which led to the use of condensed steam instead of hot water. A condenser having about 3,500 square feet of tubular surface was made and erected, the tubes being immersed in cooling water kept to about 170° F.; steam of 15-lb. pressure was received from a large tubular boiler fitted with a dome fifteen feet high, and into this tubular condenser the steam was condensed to a temperature of about 180° and then driven into a small tank called *de-aerator*. The air was expelled and the hot water was then sent through a cooler and into a large reservoir, from which it was passed into a cooling jacket and into the ice cans. The result of this experiment was conclusive as to the practicability of making transparent ice with distilled water.

Other experiments were made by Mr. Wm. Golding, an engineer of New Orleans, the object of which was to compress the blocks of twenty-five pounds into a solid one of 100 pounds, by means of a powerful hydraulic press built for the purpose. The ice, instead of being transparent, became opaque, and this experiment was abandoned. The next step was to make a block of ice of 1,500 pounds weight with distilled water. This block was solid in about seventy-two hours, and was entirely free of any air bubbles, and as clear as glass. This last experiment was so encouraging to the company that they voted to change their baths to a capacity of ten tons per day, and to hold cans 11 × 11 × 32 in. of 105 pounds weight. This size, if I am not mistaken, has been pretty generally adopted by manufacturers of machines of the immersed type up to the present day; some, however, prefer to make cans to hold 200 pounds.

THE FIRST MACHINES TO MAKE ICE ON A COMMERCIAL SCALE IN THE UNITED STATES.

These machines stimulated enterprising parties commercially inclined to inquire into the manufacture of artificial ice to such an extent that frigorific agents other than aqua ammonia were for a time tried by inventors, the difficulty of holding it without loss and under such pressures being one objection with some. Among these cold producers were sulphuric ether, methylic ether, bi-sulphide of carbon, chymogene, trymethylamine, sulphur dioxide, carbonic acid gas, compressed air, and, again, anhydrous ammonia gas liquefied by mechanical compression.

REFRIGERATING WITH ANHYDROUS AMMONIA.

In 1869 Mr. George Merz, a prominent brewer of this city, imported a small refrigerating compression machine from the works of Mr. Charles Tellier, the inventor, at Paris, France, at considerable cost, and erected this machine in the brewery premises, with the object of producing cold, dry air, and to make ale and lager beer without ice.

This machine, although well constructed, was evidently too small, and not strong enough to stand the working strains of anhydrous ammonia. It was probably designed by the inventor for the use of methylic ether, and by the parties who sold the machine afterward transformed into an ammonia machine, after M. Tellier obtained his patents for the use of liquefied anhydrous ammonia used as a *succedaneum* to methylic ether. The pump was 2½ × 7¼ in. stroke, and had to run from 250 to 350 revolutions per minute; and having often to compress gas up to 300 pounds per square inch, the shaft being double crank, driven by belts over twin pulleys, kept breaking down and the temperature of the cellar could not be reduced above 2°. It became troublesome to manage under those conditions, and it was discarded.

In the fall of 1869, Mr. Merz engaged the writer to design and construct an improved machine, the refrigerating agent to be anhydrous ammonia, and of the double-acting compression type. It was erected in the spring of 1870, in place of the old one. It worked successfully for two seasons for the purpose of making ale; and the temperature of the cellar, which contained 40,000 cubic feet, was easily kept to 40° F. The air was exhausted by a fan blower from a conduit placed near the ceiling and extending lengthwise with the cellar. The air was admitted through several small openings, and was forced through a series of tubes contained in a cylindrical boiler iron vessel into the front end and bottom of the cellar. The tubes were immersed in the liquefied gas, and by the rapid evaporation produced inside by the action of the pump, the air was delivered at 32° degrees in the cellar. I soon found out that this method would be defective, on account of the aqueous vapors the air contained becoming frozen in the tubes, and the air supply being diminished, the machine had to be stopped often to allow the ice to melt.

I tried another experiment on a small scale with a short, zig-zag coil, through which I passed a current of ammonia gas at the top and delivering it to the pump from the bottom of the coil. This worked well, and was encouraging for a while; but it became leaky on account of the poor material it was made of, and the joints being defective. The cellar which contained this coil became so impregnated with ammonia that some of the ale had to be turned out into the ditch. Mr. Merz objecting to this system, I proposed to circulate brine through the coil and use it for cooling beer in place of the Beaudelot; but being afraid the beer would come in contact with the brine, we concluded to alter the machine so as to make ice. This machine produced five tons of ice during the following summer, or 1872. The ice was placed upon the casks as in the old style. It worked in this condition for two years, until the death of Mr. Merz, when the brewery property was sold to the present owners, the Southern Brewing Association, and the machine was taken out to make room for improved ones.

There being no demand at the time for anhydrous ammonia, I had to make an apparatus to render it anhydrous, by passing it through quick lime and caustic soda, while in transit to the pump, a solution of aqua ammonia at 20° Beaumé costing twenty cents per pound, the cost of the liquefied gas being $6 per pound.

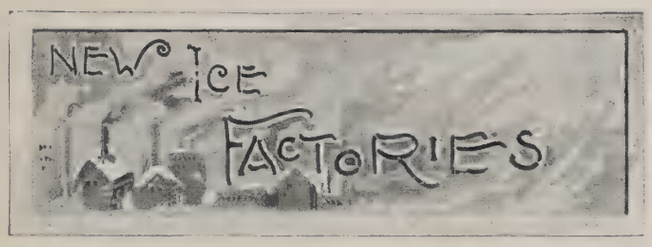
Since the successful working of the Louisiana Ice Works and the experiments at Merz's Brewery, the manufacture of artificial ice and the production of cold, dry air have become two of the most important industries in the United States. There is hardly a brewery in this country that can get along without a refrigerating machine; and inventors, availing themselves of the fine opportunities offered in this field, have applied their devices to make ice by the immersed can or the plate systems, and to refrigerate by the brine circulation or a direct circulation of ammonia processes, different systems having been adopted, either the mechanical compression, the chemical affinity or absorption process, each one having its advocates, but in each case, ammonia gas being prefered.

POSSIBILITIES OF THE APPLICATION OF AMMONIA.

The application of anhydrous ammonia to the various industries bids fair to become almost indispensable. As a motive power, a station could be erected to liquefy the gas and send it through mains to buildings, there to produce power; and other mains placed alongside would bring the exhausted gas back to the station to be re-absorbed and regenerated into liquefied gas and weak liquor.

A company under the management of Mr. P. J. McMahon, the inventor, will soon run a line of cars from their station to the Chicago Exposition, which is being considered a success, both practically and financially.

The cold produced by the expansion of ammonia or other highly volatile gases could also possibly be applied to the sinking or building of piers or foundations in deep rivers for bridges or other construction of a sub-aqueous nature. A network of large pipes could be sunk to bed rock, and so bound together as to form a strong frame; a refrigerated solution could be circulated through these pipes until the whole would become a solid mass of ice of several feet in thickness, when the interior of the pipe dam could then be pumped out, and the work of building be proceeded with. If quicksand can be frozen, why not water, as above suggested?



The ice machine manufacturers all over the country are very busy with orders already placed and in figuring on new plants. The constructive season is now under way, and the outlook is that a large number of new factories will be erected during the winter and spring. In fact, business at the machine shops is so universally active that it is safe advice to give to all who contemplate installing plants: Do not delay longer than is absolutely necessary in completing your arrangements and in placing your order for machinery and erection of plant. As spring and summer approach, the desire to get plants erected will be more and more urgent, with the result that late buyers will be in danger of having the completion of their works delayed until well into the working season. It is obvious that the plan of starting up works in time to accumulate a stock of ice against the daily demand of midsummer in excess of daily freezing capacity is a good one, and the profit from a stock in store at that time will warrant pushing the preliminary work now to be in complete shape to reap the full possible profit from the first season's run of a new plant.

Our monthly record of new works, enlargements, repairs, etc., is as follows:

ARKANSAS.

Arkansas City—There is talk of putting up an ice factory.

Fort Smith—The Border City Ice & Coal Co. are putting up a new 35-ton machine, the coil work having just been completed by the Louisville Pipe Bending Co.

CANADA.

Toronto—In connection with the action of the medical health office prohibiting the cutting of ice in Toronto bay and other places where danger is apprehended, it is reported that a company is being organized in London, Eng., and Toronto, by the exertions of C. V. M. Temple, for the purpose of supplying Toronto with manufactured ice and cold storage.

COLORADO.

Denver—Oliver C. Boyd, of the Automatic Refrigerator Co., of Muscatine, Iowa, and Lancaster, Pa., was here December 3, looking up the matter of establishing a branch plant.

Fort Collins—J. W. Bailey and Dr. S. R. Quick, of Edinburg, Ind., are considering the matter of erecting an ice factory. They own similar plants at other points.

CONNECTICUT.

Hartford—J. P. Curtis has begun the preliminary work for erecting an ice factory.

New Britain—Ground has been broken for the erection of an ice factory to cost $30,000.

FLORIDA.

De Land—J. B. Congle, Frank Bond, J. T. Clarke and others have incorporated the De Land Manufacturing Co., to manufacture ice, etc.

Tavares—St. Clair Abrams is in negotiation with Northern capitalists to erect an ice factory.

GEORGIA.

Atlanta—A 10-ton ice factory will be erected. W. A. Henderson can give information.

Fort Valley—H. C. Harris, G.H. Holgate, N. Dietzen, S. H. Rumph and others have organized a company to build an ice factory. H. C. Harris has the matter in charge.

ILLINOIS.

Chicago—The secretary of state, December 6, issued a license for incorporation to the Chicago Pure Ice Manufacturing Co., Chicago, capital stock, $100,000; incorporators, August W. Lang, Henry A. Heideman and Charles M. Keller.

Chicago—The F. L. Galigher Co., Chicago, has been licensed to incorporate to manufacture ice and refrigerating machines; capital stock, $30,000; incorporators, Frank L. Galigher, John P. Hely and Silas Rhoades.

Danville—The Pure Ice and Cold Storage Co. has been organized at Danville, with a capital stock of $30,000.

Joliet—A Mr. Baird, of Chicago, is trying to interest Joliet people in the project of an ice factory. He proposes a company with $65,000 capital stock, one-half to be taken by local capitalists; or, he will himself build the entire plant if he can secure enough takers of ice to warrant the investment. He wants to locate as near the center of the city as possible, and will begin building at once.

Sparta—Citizens are talking of erecting an ice factory.

INDIANA.

Fort Wayne—The Fort Wayne Artificial Ice Co. will enlarge their buildings.

KENTUCKY.

Covington—The Ice Delivery Co., capital $50,000, has been incorporated here by Walter H. Field and others to manufacture ice and establish a cold storage plant.

Covington—F. R. Bryson has contracted with the F. L. Galigher Co. for a 3-ton ice machine for cooling ice boxes in his apartment house.

Louisville—The Northern Lake Ice Co. have just put in two 30-ton machines, the coils having been made and fixed by the Louisville Pipe Bending Co.

LOUISIANA.

Algiers—The plans and specifications for the new 10-ton ice machines, and also all the machinery for the electric light plant for the proposed ice and electric light works to be erected in Algiers, are being prepared by Mr. J. W. Webert, the architect and engineer in charge of the new corporation.

Donaldsonville—The Donaldsonville Ice Co., previously mentioned, has purchased a 15-ton "Hercules" ice machine.

Lake Providence—The Lake Providence Ice Co. has been supplied by the National Ammonia Co. with prime charge of ammonia, and begun operations.

New Orleans—The Southern Ice Co. will put in a 30-ton Blymyer ice machine, and also have their old Carré machines reconstructed on the Blymyer plan, so that their total daily capacity will be seventy tons of ice, with cooling water at 90° F.

MARYLAND.

Baltimore—The Maryland Ice Co. is making extensive additions to its factory on South Wolfe street. Five new ice houses are in course of construction, the storage capacity of which will be 30,000 tons. These ice warehouses will front ninety feet on Wolfe street, and extend back 240 feet toward the water front, with an extensive wharf between.

MASSACHUSETTS.

Cottage City.—Clofus Gonyon will put in an ice machine.

MISSISSIPPI.

Natchez—The F. L. Galigher Co. is at work enlarging the capacity of the Natchez Ice Co.'s plant to double its former product. They are also putting in an electric light plant.

MISSOURI.

Joplin—The Frigid Ice Manufacturing Co., operating a Blymyer machine, is enlarging capacity for next season. Expecting to double the production of ice, the company is also enlarging their storage capacity.

St. Louis—The Klaussman Brewing Co. are building a large ice factory.

NEW JERSEY.

Plainfield—The Plainfield Ice and Cold Storage Co. has filed articles of incorporation at Elizabeth: capital, $50,000. The company will make artificial ice and erect storage warehouses at Plainfield for the preservation of meat, fresh vegetables and provisions. The incorporators and present stockholders are Charles A. Reed, of North Plainfield, Aaron D. Thompson and Hobart E. Rider, of Plainfield.

NORTH CAROLINA.

Eadenton—A Cincinnati syndicate has contracted with the F. L. Galigher Co. for the erection of a 15-ton ice plant here.

Raleigh—The Raleigh Plate Ice Co., whose factory was burned recently, will reorganize on the co-operative plan if sufficient encouragement is received from ice consumers and patrons of the cold storage house.

OHIO.

Logan.—The Crystal Ice Co., capital $10,000, has been organized, Wm. Waner being president, Chas. Myers, secretary and treasurer. The work of construction will begin at once.

Washington C. H.—The Washington Ice Co. are building an ice house, fifty feet square, to hold 1,000 tons, to store ice made to meet the extra demand of summer.

Youngstown—The new ice manufacturing company has secured all required subscriptions of stock, and P. M. Joyce and William Park have been appointed a committee to inspect plants before machinery is purchased.

OKLAHOMA.

El Reno—The Anheuser-Busch Brewing Association have in contemplation the erection of an ice factory and cold storage plant; and may also establish a system of water works, supplying the city, as well as their own plant, with water.

Guthrie—J. Schuehle has sold his ice factory to the Pabst Brewing Co., who will enlarge it to a 25-ton plant.

PENNSYLVANIA.

Philadelphia—The incorporation papers for the Fairmount Ice Manufacturing Co., 2031 North Twentieth street, have been filed. Capital stock, $400,000. Work was started December 15, on the new plant.

Philadelphia—An ice factory is to be added to the G. Manz Brewing Co.'s plant, at Sixth and Fairhill streets.

TENNESSEE.

Harriman—The Emory River Ice Co. has been organized, with J. D. Wolstenholme as president; W. C. Spicer, vice-president, and J. F. O'Keef, secretary, for the purpose of erecting a 10-ton ice factory. The capital stock is $20,000, and the plant will cost $17,000.

Humboldt—Bear Bros. will enlarge their ice factory.

Knoxville—The ice factory at West Knoxville is being thoroughly overhauled from top to bottom.

Memphis—The People's Ice Co. has resumed operations after having been shut down for two years under a local agreement.

Nashville—The newly incorporated Ice, Coal and Cold Storage Co. organized December 18 by electing Ben F. Parker, president; W. H. Hyronemus, vice-president; W. W. Wingel, superintendent and Edward Schoenpflug, secretary. The company's establishment will be located in East Nashville. They will make and sell ice, sell coal, and do a cold storage business.

Pittsburg.—The building of an ice factory is in contemplation.

TEXAS.

Alvin—The Fairwood Ice and Cold Storage Co. will, it is stated, establish an ice factory and cold storage plant at Fairwood.

Aransas Pass—Mr. G. W. Barton has taken out the machine put into his factory last April, and has purchased a 10 ton "Hercules" machine to take its place.

Austin—The Haigler Bros. can give information of a new ice factory in contemplation.

Austin—Mr. Zilker is making some improvements at his ice factory.

Beaumont—The Beaumont Ice, Light and Refrigerating Co. is reported as enlarging its plant by the erection of an additional building, 60×100 feet, and as to shortly make other needed improvements.

Dallas—The Anheuser-Busch Brewing Association will erect a new ice factory. The association has also acquired an interest in the Dallas Ice Factory and Cold Storage Co., whose plant of 40 tons will be increased to 150 tons daily capacity.

Dallas—The Dallas Ice Factory and Cold Storage Co. are adding a 40 ton ice machine to their plant, which arrived in Dallas December 12.

Gainesville—The Gainesville Ice Co. will enlarge their plant from fifteen to twenty tons, under the direction of the F. L. Galigher Co. They will also put in an electric light plant.

Gonzales—Henry Beringer has bought the ice factory here, which he will enlarge.

Hamilton—F. L. Fisher has in contemplation the erection of a small ice plant.

Hillsboro—J. R. Young is erecting an ice factory here, to be completed by April 1st, of 7½ tons capacity.

Houston—A. Remmells, agent of the Anheuser-Busch Association, has perfected all arrangements for the location of an ice factory of sixty tons daily capacity, to be ready for service next season, and to cost between $100,000 and $130,000.

McKinney—E. W. Morton has purchased the ice factory at McKinney, and will probably enlarge its capacity, as well as do a bottling business.

Paris—The Arctic Ice Co. has let contract to the Hercules Iron Works, of Chicago, Ill., for the erection of a 15-ton ice plant.

Taylor—The Taylor Ice Co. is reported as to put new machinery in its ice factory.

Velasco—The Velasco hotel is reported as putting in an ice plant.

Victoria—Electric Light Plant and Ice Factory. W.T. Gaines has leased the Victoria Light, Power and Ice Co.'s plant. He will double the capacity of the electric light plant, and improve the ice factory and put them in operation.

VIRGINIA.

Berkley—The Berkley Market and Stockyard Co. expects to put in a 10-ton ice plant.

Luray—The Luray Inn is putting in a 10-ton ice machine, the F. L. Galigher Co. doing the work.

Norfolk—The Hygeia Ice Co. is putting a 35-ton absorption ice machine in its ice factory in Brambleton that will enable it to double its capacity.

WASHINGTON.

Olympia—John Irwin, of Steubenville, Ohio, expects to erect an ice factory.

THE FIRE RECORD.

——The cold storage house of James W. Sheldon, at Albion, Mich., was burned December 1; cause, incendiary.

——The ice houses and barns of Jackson Allen and W. S. Tompkins, at Chappaqua, N. Y., were destroyed by fire.

——The Holdredge creamery and cold storage building at Holdredge, Neb., was burned November 28; cause, engine; stock a total loss.

——McCarthy Bros.' ice house at Norfolk, Mass., was burned December 17; and 2,000 tons of ice and a lot of tools destroyed; loss on house, $3,000.

——At a fire at Paterson, N. J., December 8, involving several establishments, the Artesian Well Ice Co.'s plant was damaged $1,000; no insurance.

——The Knickerbocker Ice Co., Philadelphia, lost $400 by damages to sheds December 10, caused by a fire originating in adjoining terra cotta works.

——Henry Bruning's ice house at Seymour, Ind., was burned November 24, by a fire originating in a chewing gum factory adjoining; loss, $400; no insurance.

——The cold storage house of the Anheuser-Busch Brewing Association, at San Antonio, Tex., was totally destroyed by fire November 22; loss, $10,000; insured.

——The ice factory at Palatka, Fla., belonging to S. C. and L. J. Canova, valued, with its contents, at about $18,000, was totally destroyed by fire December 1; insurance, $12,000; cause unknown. The owners will rebuild.

——The slaughter house and refrigerator in the town of Allouez, Wis., belonging to Joseph Kalb, of Green Bay, were completely destroyed by fire December 15, entailing a loss of $4,600; insurance $2,400 on the buildings. It is Mr. Kalb's intention to rebuild at once.

——The new steamship *Ophir*, built for the Orient Line, England to Australia, is provided with refrigerating apparatus by J. & E. Hall, of the Haslam Foundry and Engineering Co., Ltd., of London and Derby, refrigerating by compressed air. The machine is of the compound duplex type, fitted with surface condenser, the size of steam cylinders being 16 inches and 27 inches, respectively, with a stroke of 24 inches. It is constructed to work either as a double machine or two single refrigerators, which can be worked independently if required. The crank shaft, valve rods, piston rods and connecting rods are made of the best mild steel. The apparatus is self-contained. The cylinders are mounted on the top or face of a massive cast iron bed plate, to which is combined the condenser, and to the bed plate are also fitted the pumps. The installation includes, also, patent copper drying pipes. The apparatus is designed to circulate 70,000 cubic feet of air per hour when working at its minimum speed of sixty revolutions per minute, or 105,000 cubic feet per hour when working at ninety revolutions per minute. The machine is designed to refrigerate a space of 50,000 cubic feet capacity, which will hold about 17,500 carcasses of mutton, and maintain a temperature of 15° F. in the tropics.

——The ice factory at Fernandina, Fla., is shipping ice to Cedar Keys.

——The stockholders of the Jeffersonville Ice Co. and those of the Jeffersonville Brewing Co., of Jeffersonville, Ind., are talking of consolidating the two concerns.

——A. C. Gibbons & Co., owners of the ice factory at Dayton, Tenn., have made the city authorities a proposition to supply the streets with arc electric lights, which has been accepted.



The heavy snow fall and cold weather of the middle of November and early part of December have been succeeded by mild weather and copious rains in the Northern states, which have done much to fill up the rivers shrunken by the summer and autumn drought, so that the prospect of abundant water in the cutting field is better than a month ago. With cold, ice-making weather after this date, there seems no reason to doubt the cut will be as large this year as ever, if not larger than the average.

IN MAINE.

The Bangor *News* thus editorially sums up the situation December 1 in the important cutting field on the Penobscot:

Where are the ravens that were croaking over the poor prospects of an ice crop in the Penobscot a few weeks ago? Last month the know-it-all papers were lamenting the non-appearance of rain, complaining about the saltness of the water, and telling how no ice could be cut in the river this year. Some papers even went so far as to state that the water as far up the Penobscot as above the Great Works dam was salt, and intimated that lobster and codfish were working up toward the base of Mt. Katahdin fast, and it seems that one set of papers knew as much about it as the other. There have been two sharp rains lately, causing the river to rise rapidly, and washing off all the fallen leaves and other impurities from the courses of the shrunken streams, and carrying the filth far out to sea. Even if the river were to freeze up now, of which there is little probability, the ice would be good, though two or three smart rains are needed to swell the river and cause the ice to freeze rapidly, for it is a well known fact that while salt water will freeze fresh ice the trouble with this ice is that it freezes slowly, so that the ice men have to wait a long time before they can begin operations. While this danger is past in Bangor and vicinity, owing to the late rains, it is hoped and believed that more rain will fall, thus improving the quality of the ice, and by widening the river increase the amount of ice that can be cut.

Beyond doubt there will be more ice cut on the Penobscot this winter than ever before in the history of ice operations in Maine. The ice men see how they made a sad mistake in not cutting more last winter, as the prices paid this summer, while not large, were sufficient to pay all expenses and leave a good margin for profit. Such an opportunity will not be allowed to go by again. Maine ice is now the standard in the market, and it is in increasing demand at better prices every year. To keep up the reputation of the Penobscot for furnishing good ice it is needful that a good crop be harvested every winter. So it is probable that never again will there be so little ice harvested on the Penobscot as there was last winter. The tide has turned. The ice trade will grow rapidly from now on.

At Gardiner, Maine, over on the Kennebec river, the *Home Journal* says:

The continued mild and pleasant December causes some speculation already among our ice men on the prospect of the coming ice harvest. The general prediction by the "weather cranks" of a cold and blustering winter, has lost its weight somewhat. Nearly all seem to express the opinion that they experienced cold and blustering weather enough last winter for something more mild this. The river closed last year December 1, and the ice scraping commenced December 6, and continued during the cutting season. Thus there seem reasonable grounds for the weather prophets to moderate a little before January passes.

In looking over the ice houses, the excellent condition of them all was particularly noticeable. We have not seen for years so many substantial repairs being made as are now under way. Five new elevators and machinery have been put up, and all repairs are of the latest plan of building, and the elevators are the most improved machinery with endless chains.

WILL TRY TO STOP POLLUTION.

At Burlington, Iowa, the ice men have begun a laudable war on the gas company of that city, which pollutes the river above the ice cutting fields, by depositing the refuse of the gas works in the river. A leading ice man of the city said recently:

We have staked off our claims for the ice harvest, but we propose before we do any cutting to see if we cannot obtain an order from the health department of the city, or failing that, a restraining order from the courts that will prevent the discharge by the gas works of thousands of gallons of coal tar into the river. From this practice alone the ice men of Burlington suffered damages to the extent of thousands of dollars, and we will not cut this year if we are to be annoyed in the same way. Much of the stock put up last year was unfit for use, all of it had to be sorted, and while some that was less badly tainted could be used for refrigerating rooms a great deal was so strongly impregnated that we were obliged to throw it away. Last winter most of the ice stored here was cut far above the city, and floated down to the levee, and in so doing it was tainted by the refuse from the gas works. It is a matter that concerns every householder and consumer of ice in Burlington, for if the home dealers cannot cut their stocks from the river and obtain pure ice they will be obliged to buy from points north, and the railroad freights will necessarily enhance the cost to the consumer.

This movement by the ice dealers is certainly one to be commended. Americans have gotten into a most reckless habit of polluting their water courses by sewage and offal, which, if continued for a few more generations, will make a cess-pool of the whole nation. It is eminently unscientific, and has by law been stopped in all civilized countries of Europe. The streams are steadily decreasing in volume, wherever the land is cultivated, even without filling them up with sludge; and if the ice men of the country, even if it be only for their own protection, can put a stop to river pollution, they will have earned a debt of gratitude from the whole country.

ICE POLLUTION IN CANADA.

Toronto, Canada, is another of the towns that is systematically creating a nuisance of its harbor, the sewage of the city being emptied into the bay which forms the harbor, which sooner or later will become a menace to the city's health. The water has already become so permanently polluted that the popular outcry against the ice dealers has broken out in the city with so much vigor that the local board of health has passed an order prohibiting the ice dealers from future use of the bay as a cutting field. An effort was made to compromise, by inducing the board to allow ice from the bay to be used for refrigerating purposes only, other supplies to be obtained from unpolluted streams; but this was not allowed. Following is an extract from the proceedings:

Ald. Atkinson moved that no ice be cut from Toronto bay or other impure sources, and that all ice used in the city should be fit for domestic purposes. In support of the resolution Ald. Atkinson said that if he had to choose between the health of the citizens and the pockets of the ice dealers, he must without hesitation decide in favor of the citizens.

Ald. Burns, who headed the ice dealers' deputation, said he could assure the board that there need be no difficulty in arranging matters so that no harm need come to any one. The ice dealers were prepared to submit to the most stringent regulations, such as entering into a bond not to sell cooling ice for domestic purposes, and to have separate wagons for the two qualities of ice. He objected to paying the railway companies $100,000 for hauling ice to the city.

After some discussion Ald. Atkinson's motion carried, and then Ald. Small wished to know if the water in Toronto bay was found perfectly pure on the first of January, could the ice dealers cut from the bay?

Ald. Graham—No, certainly not. This resolution must be rescinded before any ice can be cut from the bay.

The by-law prohibiting the cutting of ice from Toronto bay, Small's pond, Ashbridge's bay, Humber river, and the Don was then passed.

Thus, it will be seen, the Toronto dealers will have to find new cutting fields: but it does not appear from the record that any movement has begun to remedy the evil of which these proceedings are an evidence.

AT NEW YORK.

The cold snap which began in New York on Thanksgiving day, and on November 30 gave that city the coldest November day known there in thirty years, started the local companies out for the Hudson river cutting fields in a hurry. On December 1 the *Tribune* said:

The Knickerbocker Ice Co., which annually handles from 1,200,000 to 1,500,000 tons of ice, has already shipped several hundred of its horses up the Hudson river before navigation closes, preparatory to opening the ice harvest. Scores of men are engaged along the river at Marlboro and eighty miles up the Hudson to Coeymans, where the bulk of the ice is cut, whitewashing the fifty and more ice houses of the company, replacing the decayed planks, storing up sawdust and hay, and preparing the stables for the horses that are used in the cutting and hauling of ice. Quarters for the many thousands of men who are engaged in this ice harvesting are also being put in repair or secured, while blacksmiths' shops are being brushed up and harnesses and implements for ice cutting are being put in readiness for use.

The water in the Hudson river where the ice is usually cut, however, is not yet frozen over, even in the bays and places where the water is quiet, for although the cold has been sufficiently severe to freeze, yet the water has not been chilled through, and is yet warm, compared with the temperature of the atmosphere. Other ice companies, such as the Consumers' and the Ridgewood, are making extensive preparations for an abundant harvest. Although these companies say that the ice season is getting later and later every year, and that for the last fourteen years no ice has been cut before Christmas, yet the goosebone has been so wonderfully auspicious this year that it behooves them to be getting ready unusually early. The failure of the ice crop in the winter of 1889-90, and the reaping of only a partial crop in the winter of 1890-91, has rendered these companies anxious to avail themselves to the utmost of the promised plentiful harvest.

The Hudson river ice men are not alarmed at the weather. They prefer a short, active season to one in which snow storms and freezing weather alternate, when they are compelled to begin work early only to be interrupted by thaws or the bother of scraping snow from the ice. A short season, beginning early in January and lasting six or eight weeks, with plenty of ice and no snow to speak of, would enable them to fill their houses at much less expense.

What it means to fill the houses along the Hudson, or, in other words, what the annual crop of ice amounts to in tons, is not generally understood, says the New York *Sun*, and has never been known except to the large ice companies of New York city, who are obliged to keep watch each year of the total number of tons harvested by others, as well as by themselves, in order to regulate the market price, and know where to go in case their supply runs short during the summer. It has been estimated that 3,030,500 tons can be housed in the 128 houses along the river. To that total may be added a safe estimate of 500,000 tons, harvested by small individual dealers, brewers, butchers, and the like, and stored in small houses away from the river. New York city ice companies take the bulk of the 3,000,000 tons to the city either for reshipment to other ports or for consumption there, and also take from ponds and lakes adjacent to New York, south of Poughkeepsie, about 450,000 tons more, so that the ice crop of the Hudson valley south of Albany may be safely estimated at 4,000,000 tons. The harvesting of the crop gives employment each winter to an army of farm hands, brick workers, canallers and river men, who would otherwise be unemployed, and according to the estimate of a well informed ice man, necessitates the expenditure in the five counties of Albany, Rensselaer, Greene, Columbia and Ulster, of more than $750,000 for cutting and housing.

NATURAL ICE NOTES.

——L. Hale has built a new ice house at Glasgow, Ill.

——T. R. Foley is building an ice house at Aitkin, Minn.

——B. M. Ames is building an ice house at Bristol, N. H.

——Wm. Sinz has built an ice house at Glenbeulah, Wis.

——M. K. Clark will erect an ice house at Bloomington, Ill.

——G. E. Emmons has built an ice house at Morrisville, Vt.

——Jacob Dolisi is putting up an ice house at Endora, Kan.

——J. H. Goetschius is erecting an ice house at Paradise, N. Y.

——John Landers is building an ice house at Whitesboro, N. Y.

——B. Hinchman is putting up an ice house at Sawyer, Mich.

——Judge Sweezey's ice houses at Blue Hill, Neb., are completed.

——G. H. Brown is building an ice house at Rockville, Conn.

——Dexter & McCausland will go into the ice trade at Pittsfield, Me.

——W. T. Elliott is erecting an ice house at North Cameron, Mo.

——M. Miller is building an ice house on North Ninth street, Atchison, Kan.

——The Park City Ice Co., Park City, Utah, has finished a 5,000-ton house.

——Ice men about the northern Indiana lakes are preparing for business.

——Featherstone & Keith are erecting an ice house at East Las Vegas, N. M.

——Burnham & Co. are building an ice house at Otter pond, Sebago Lake, Me.

——Wm. Corah, dairyman, will harvest ice from his pond at East Aurora, N. Y.

——Heidt & Lerch succeed John Heidt in the ice business at Davenport, Iowa.

——Several new ice houses are building at Lake Zurich, near Waukegan, Ill.

——J. G. Winters, of Strong City, Kan., is building a large addition to his ice house.

——George C. Harlow is building an ice house and creamery at Westminster West, Vt.

——Ice cutting on Prosser Creek (Truckee, Cal.) began December 18 with 10-inch ice.

——The Carpenter Co., at Northbridge, Mass., will rebuild their houses burned last spring.

——The ice house at Sloan's Lake, Cheyenne, Wyo., will be enlarged by a 16×70 ft. addition.

——Charles Norris is about to extend and otherwise improve his ice houses at East Edgecomb, Me.

——On December 10 only 50,000 tons of old ice remained on hand in the houses on Kennebec river.

——Mr. Silas Burt is building a substantial ice house on the lot east of his old ones at Mishawaka, Ind.

——Mr. I. L. Joran is building a new ice house, 18×30 feet, near the Adamsdale pond, Adamsdale, R. I.

——S. F. Darling is erecting three new ice houses at East Providence, R. I.: total capacity, 7,500 to 8,000 tons.

——The first lot of ice (five inches thick) for the season, 500 pounds, was cut on the pond at Chambersburg, Md., on December 10.

——The Crystal Lake Ice Co., Hastings, Neb., has finished work on their lake, which will be filled from the Blue river. The lake is also fed by springs.

——J. Hauenstein, of New Ulm, and George Ross, of Springfield, Minn., have erected an ice house at Springfield, and will conduct a retail business.

——John Reesman and John Whittier are erecting an ice house at Curwensville, Pa., and expect to fill it with ice this winter for the use of their customers.

——Wm. Martin & Son, at Crawfordsville, Ind., are increasing their capacity by the addition of another large house, which will give them storage capacity for three seasons.

——The State Board of Public Lands and Buildings, of Nebraska, on November 28 awarded the contract for building a new ice house at the industrial school at Kearney, to cost $1,039.

——Hodgkins, Hall & Co. are repairing their ice houses at Bangor, Me., which were formerly owned by the Kineo Ice Co. If this season's cut promises to be profitable, they will house 35,000.

——The Keuka Lake Ice Co., Watkins, N. Y., is building a new ice house at the foot of the lake. The new structure will be 100 feet long and forty feet wide, and will hold about 3,750 tons of ice.

——The Boley Ice Co., Pekin, Ill., have torn down their ice houses at Madison, Wis., and have shipped the lumber to Pekin, where they will erect new houses for the ice they expect to harvest there this season.

——Samuel Darling, of East Providence, R. I., is building three new ice houses on the Ten Mile river to take the place of the ones that were burned last winter. He is pushing the work as rapidly as possible.

——Some ice has already been cut on the Sioux, by Sioux City, Iowa, firms, and men are at work preparing to harvest the winter crop. Some of the ice companies have still from 7,000 to 10,000 tons of last year's cut on hand.

——The Truckee, Nev., ice men have everything in readiness for the harvesting of the ice crop whenever the same is ripe enough to cut. The past season has been a good one, and the companies had only about 25,000 tons remaining on hand.

——The Wisconsin Lakes Ice Co., of Milwaukee, has purchased the farm of Mrs. Elizabeth Gaul, near Dousman, Waukesha county, Wis., for $4,000, for the purpose of getting possession of the lake frontage for cutting ice for shipment to Milwaukee.

——The American Ice Co., Bangor, Me., November 27, chartered the barkentine *Skobeleff* (of Portland) then at Bucksport, to load ice, etc., for Washington, D. C. This was probably the last shipment of ice from the Penobscot river for the season.

——The Twin City Ice Co. and the Mississippi Ice Co. of Rock Island, Ill., whose ice houses in Watertown are located very near together, are putting in new steam equipment for convenience in packing their houses. Another large house is also being built.

——John Krause and Henry Painter have formed a partnership, to be known as the Mansfield Ice Co., at Mansfield, Ohio, ice supplies to be cut from a rural lake, formerly occupied by the Wagner Lake Ice Co. The new firm will have storage room for 2,600 tons.

——The Pawtucket Ice Co., Cumberland Mills, R. I., had nearly completed its new ice house, but during the storm of December 4 the greater part of the building that had already been erected was blown down, so that the work will all have to be done over again.

——Work is being rapidly pushed rebuilding the Armstrong ice houses at North Indianapolis, Ind., which were destroyed by fire last September. The houses, eight in number, contain dead air walls, avoiding the use of sawdust. They will have a capacity of 33,000 tons.

——F. P. Hesnard, of Hot Springs, Ark., has commenced the erection of a dam up at Cold Brook, near that city, which will back up the water so that he can take ice from the pond thus formed. He soon commences the erection of an ice house having a capacity of 1,000 tons.

——A Laconia, N. H., correspondent says that, "Ice men from down country have been in this vicinity recently staking out claims. This is done upon the theory that lack of water in the ponds in Massachusetts will make a short ice crop. They can get all they want in this section for the cutting."

——The Knickerbocker Ice Co. has withdrawn its employes and removed its ice cutting implements from Oconomowoc to Madison, in consequence of the demand of parties who claim to own the bed of Fowler lake for pay for the privilege of cutting ice. Last winter that company paid out some $6,000 in Oconomowoc for labor.

——During a furious wind and rain storm December 4, along the Maine coast, three ice houses at East Hampden, owned by C. G. Sterns & Co., were blown down. The houses were over 200 feet long, probably thirty feet wide and thirty feet high, and had a capacity of 15,000 tons. The same houses have been blown over twice before.

——A Portsmouth, N. H., paper says: "The first ice house in the city was built twenty-seven years ago by Henry C. Lord, then president of the Erie railroad. There are four ice houses within the borders of the town, and a great many more in the vicinity; but unless there shall be plentiful rainfalls before snow, the production will be very limited this winter."

——The Walker Ice Co. is building a large ice house at Coes' pond, New Worcester, Mass., which, when completed, will be 320 feet long, 150 feet wide and ninety-four feet to the peak of the roof. It will contain twenty pockets, and will have a storage capacity of 25,000 tons of ice. It will require 600,000 feet of lumber and 600,000 shingles in its construction.

——The Union Ice Co., Erie, Pa., has closed a successful season, all the ice placed in the various houses having been used up. The rates in Erie during the past summer were lower than in either Buffalo, Cleveland or Detroit. The company will commence cutting ice as soon as it is six inches thick. The People's Ice Co., of the same city, will have increased facilities for next year.

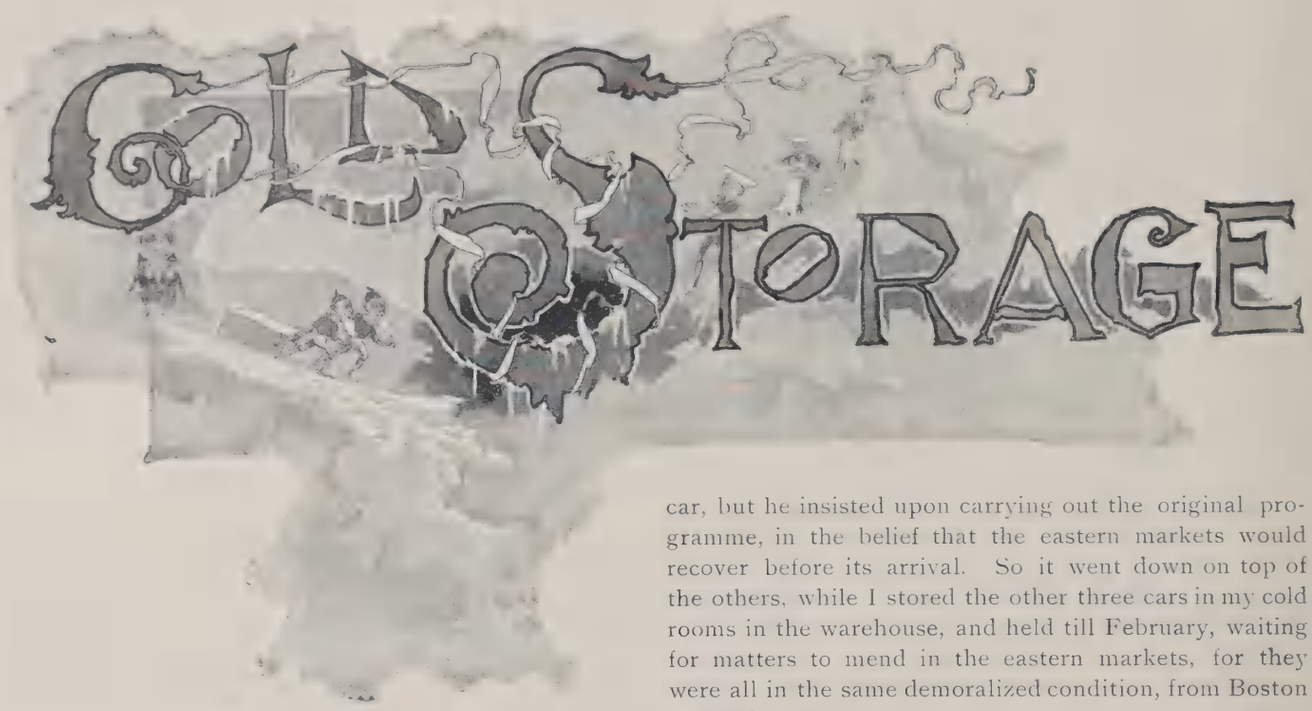
——The Superior Ice Co. is completing arrangements for putting up an ice house with a capacity of 1,000 tons at Superior, Neb. Preparations are also being made for a large shipping business, and contracts have been entered into for supplying a number of Kansas towns with ice as soon as the season opens. The company was organized some months ago, with I. L. Edsall as president and manager, and John Wyss as secretary and treasurer.

THERE will probably be no more ice palace shows and parades at St. Paul. At a recent meeting held in that city to organize an immigration society, the statement was made by a railroad official that "the tide of immigration to that country fell off appreciably as soon as St. Paul began to advertise the frigidity of the climate!" It is to be inferred, then, that if the ice palace goes the sturdy immigrant who settles in the Red river valley will imagine himself in a middle Tennessee climate, even if his legs, clothed in flannels, two pairs of pants and overalls, feel at times, when the blizzard zephyrs tamper with his whiskers, as if protected only by the gauzy textures which in the brilliant chromo swathe the nether limbs of the harem beauty. The railroad map maker having succeeded in making his road run in an air line from Chicago to Omaha *via* St. Paul, the immigration agent ought to be allowed to redeem his reputation by picturing a South-of-Europe climate along the line somewhere, even if it does run into Alaska!

A RECENT trade paper, prepared for Southern consumption, contained a series of articles on refrigeration, in which the author—who writes in a reportorial way, with the average reporter's happy disregard for strict accuracy of scientific statement—makes the astonishing observation, in italics, that "*there is no such thing as absolutely pure natural ice.*" The statement is absurd, and requires no refutation; but, as it happens, the City Ice Co., of Rockford, Ill., who in all probability never saw this series of articles, sends us an analysis of Rock river ice made by E. G. Smith, Ph. D., professor of chemistry at Beloit college, which shows the "ice to be pure and almost absolutely free from either mineral or organic matter." This condition of ice cut from unpolluted streams and lakes is by no means uncommon; rather, it is the rule. Indeed, the country over, it is much more rare to find unwholesome ice than that which is perfectly pure.

IT WILL happen even in the ice business, it seems. For the story of a Kennebec ice broker, as rehearsed in an Augusta paper, is that he purchased 10,000 tons of ice from a fellow up in New Hampshire, to whom the broker paid $10,000 down. Then the fellow sold it to New York parties, getting $5,000 down; and then mortgaged it for another large sum to a wealthy New Hampshire man, and skipped with the "boodle." And now there are three several "interested parties" looking for that fellow; for surprising as it may seem, none of them got the ice, which melted and returned as water to the river from whence it came!

THE continued mild weather through December is beginning to be noted by ice cutters, who are now watching the mercury with growing interest.



[*Written for* ICE AND REFRIGERATION.]

PRACTICAL COLD STORAGE.

THE HANDLING OF POULTRY—THE BEST WAY TO FREEZE AND PACK DRESSED POULTRY—THE FATTENING OF LIVE TURKEYS—THE STORY OF A POULTERER'S EXPERIENCE.

By D. B. Beemer.

[*Concluded from December issue, page 345.*]

I do not know what the women and children could have accomplished the next year in the way of breaking the record, for unfortunately both myself and the rival buyers were "knocked out" in the "round up" that season through neglecting to operate upon that "cast iron rule" before referred to, of "*keeping the stock frozen till it was sold.*" With my newly constructed cold storage rooms, and the promise of the use of the then new line of Davis refrigerator cars, owned by the M. C. R. R., to carry the poultry to New York, where I could store in freezing rooms and hold till ready to sell, I was in a position to do a safe business. But Mr. Stanley had insisted, as a condition of our deal, that as soon as the weather was cold enough to put up a car load in my usual style, I should start one to Boston, to be closed out on arrival upon the open market; then ten days afterward start another car, to be followed in another ten days by a third car; the balance of the crop to be entirely at my disposal to handle as I saw fit. I did not like to agree to this, but I finally consented to do so, as up to this time I had got out all right on such shipments to Boston. But the first car, in this case, struck Boston in a rainy, muddy time, with the market full of thawed-out, moldy stock, the frost having got out of it while in transit. Sales were slow and prices "flat." When the second car reached there, the first car load was only half sold out, and the balance thawed.

Boston had in those days only so-called "cold cellars" to put frozen stock in, which, in such weather as then prevailed, were of no earthly use to prevent stock from thawing out. Ours thawed out, and the market being demoralized, it could not be closed out. I tried to prevail upon Mr. Stanley to hold back the third car, but he insisted upon carrying out the original programme, in the belief that the eastern markets would recover before its arrival. So it went down on top of the others, while I stored the other three cars in my cold rooms in the warehouse, and held till February, waiting for matters to mend in the eastern markets, for they were all in the same demoralized condition, from Boston to Baltimore.

Finally I got the Davis cars up from Chicago during a spell of cold weather, iced up and loaded the poultry in, and started them for New York. I accompanied the cars to Albany, and then went down to the city in advance, engaged a freezing room from a fish firm on the docks at Fulton market, bought ice and "iced up" and awaited the arrival of the cars. They came down to St. John's Park depot, near Chambers street, and with a lot of trucks I transferred the whole lot quickly into cold storage, where my thermometer registered 26° F., and had them safely shut up from the fog, rain and mud still prevailing.

I found an awfully demoralized market, full of thawed-out poultry in all stages of decay. Peddlers' wagons and stalls were stocked with ghastly-looking stuff that had been run through hot saleratus water to clean and "sweeten" it, while every day the police confiscated tons upon tons of it from markets and commission houses to the docks; and all arrivals by freight continued to open up thawed-out and moldy, and added, if possible, to the general demoralization of the market.

The best turkey stock would bring but ten cents per pound when I got there, and other grades on down to one cent. Such a protracted spell of soft weather had not been experienced at that season of the year along the seaboard for a long term of years, and results to western shippers were disastrous.

One large shipper from a town in eastern Iowa, who was in the habit of dressing and freezing up poultry on a large scale every year, much the same as I did, had a large storehouse on the "divide" between Boston and Albany, on the railroad, where he stored his stock and held it as a distributing point for different markets, from which he ordered it shipped daily as prices warranted, depending upon the frozen stock to refrigerate itself and keep frozen, which in ordinary seasons it would do. But that season the frost started out of the packages, and mold struck through the whole mass. When he opened up in New York the first lot of boxes ordered down by the boat and found them in that condition, he reasoned that it would be only the outside boxes of the pile, up

there in his storeroom on the "divide," which the weather had affected, and that the next layer in toward the center of the pile would be found all right. However, to assure himself if such were the fact or not, he ordered some such to be sent down to him. But the boxes sent from the center of the pile opened up in as bad shape as those from the outside, and as a last resort he had the whole sent down to him, and upon their arrival he filled two cold storage rooms on West street with it, and ran a steam engine and blast blower night and day for a while, trying to freeze it up again. In this effort he failed, however, mainly owing to the fact that he *filled* the rooms with his thawed out stock, displacing most of the air in the room, so that there was not enough left in for the blow pipe from the freezing tank to have any appreciable effect upon the poultry. All he could do was to keep the peddlers at work, and work the stock off as well as he could. He lost $10,000 on his crop.

Another large shipper from Elgin, Ill., came in with seven car loads in similar condition, and his loss upon it had the effect of laying him up at his hotel with a long run of fever. In the meantime, Boston being "stuck" on our three cars, I ordered one of them to be sent down to me on the Sound steamer, and when it arrived I enlisted the peddlers' brigade, and looked on as cheerfully as I could while they worked off turkeys at three to five cents a pound that had cost us about sixteen laid down in Boston.

As to the three cars I had in cold storage, I resolved to hold on to them until the market cleared up and prices advanced. I reasoned that the losses to country shippers would cause them to stop shipping entirely, and that it would be only a question of time when the market would become bare of stock, while shipments would not begin again till high prices were offered. Being on the ground with my stock, I could safely wait for the highest figure, as I could then close out while shipments were on the way. I told the market boys I must have twenty-two cents per pound for the turkeys and the ducks, twenty cents for the geese, and eighteen cents for the chickens; and that I would stay till I got it if it "took all summer." So I attended to my icing and watched the thermometer, while I waited for the market to recover.

There were six weeks of this soft weather on a stretch, and it took till the *15th of April* for the market men to make up their minds to pay my price. Trimm & Summer, in Washington market, gave the first order for a dray load of poultry to sample up on. I brought it down, and opened up the boxes in the alley in front of the stalls. The creamy surface of the pressed birds glistened with frost, and looked very inviting to the passing crowd, who had done without poultry so long, and they made a rush at them that rapidly emptied the boxes.

Other market men came to see what caused the excitement, and finding how the matter stood came to me with orders for truck loads. In short, I closed the three car loads out inside of twenty-four hours, at full prices, and saved myself the total loss that many others were subjected to. Still, through the Boston cars, we netted a loss of over $5,000, when, if the goods had been handled as the other three cars were—kept under the power of frost from first to last—we would, on the contrary, have cleared $5,000.

The home rival house, as usual, copied my previous style of handling the stock, and had the same experience with theirs on the Boston market that we did with our three cars sent there. Mr. Stanley had enough of poultry for the time, while I and my home rivals were left such "lame ducks" that we were in no position to handle the crop of poultry off the old grounds, the next season, much to the sorrow and loss, no doubt, of our old poultry growers there. On my return to Chicago I went on to Omaha, and started there in the fruit and produce trade, to grow up with it and the country.

FROZEN BAIT.

While the American and English diplomatists are working out the problem of the right of American fishermen to procure bait, which the Canadian authorities and the *statu quo* now forbid them to obtain, as formerly, at the banks themselves, the fishermen have succeeded in solving the problem themselves; and it is not a little curious to note that refrigeration has been the means. The Boothbay, Me., *Register* thus describes how the difficulty was overcome, and how a new industry has been created:

Three or four years ago Capt. M. R. Rowe & Son discovered the method of catching the bait herring in purse seines, and then freezing the herring by artificial cold, keeping them in cold storage held constantly below the freezing point. Since that time the fleet has constantly increased, and might be increased indefinitely if a market could be created for this fish.

This year has proved quite successful up to the present time, a large number of vessels having come from Gloucester and other parts for bait. The canning factory has taken many hundred barrels and several thousand barrels have been salted to ship south. The fish have been of a desirable size for all purposes, and this business has become one of the leading branches of our fishing industry within a very short time.

During the winter months, however, these fish seek deep waters, where it is impracticable to fish for them. Hence the freezing and storing of them during the fall months render it possible to furnish a supply of bait every month in the year in quantities to suit customers, and at prices which they can well afford to pay.

If this important industry succeeds as well as it promises, it will prove a great benefit to the fishermen, and ought to stimulate our home fishermen to increase their fleet.

The other day we called upon Mr. Luther Maddocks, through whose energy this thing is being brought about in our town, at his factory on the east side of the harbor. He conducted us to a large building on his wharf where the freezing is done and the cold storage room situated, and explained each step in the process.

The fish are first packed in sheet iron pans about one foot broad and two long. The pans are then packed in a large pen or box with double walls, between layers of chopped ice and salt. After remaining in this pen for a sufficient time they are taken out, removed from the pans and piled up in the chill room, there to await the fisherman in search of bait.

We went into the chill room and examined the fish piled up there like cord wood, from floor to ceiling. They were frozen hard and stiff as sticks, and when we attempted to bend one of them it broke short off. They can be shipped long distances in tight paper-lined boxes or barrels without thawing, even in mild weather.

Mr. Maddocks gained his practical experience in this business during his stay in Portland, Ore., where he was connected with the Deep Sea Fishing Co., of that place, who deal largely in frozen fish for the New York market. He also made several trips to the great lakes and investigated the freezing of lake herring at Sandusky, Ohio, and other places, thus gaining valuable information in regard to the business.

Mr. Maddocks has been advocating this method of supplying bait for years, but not until recently has he succeeded in interesting outside parties enough in the business to get them to take hold with him.



When M. Cudahy withdrew from the Armour packing concern it was announced that Mr. Cudahy had become wearied with the cares of the great business, and, having made a comfortable fortune, would devote himself to taking life more easily. The actions of Mr. Cudahy since that time, however, do not corroborate the theory that he withdrew for his health, but rather for his wealth. He has increased the business of the great plants at Omaha and Milwaukee, and is now at the head of a scheme to erect a large establishment at East St. Louis, besides being interested in other new ventures in this line, as will be seen by reference to our news items. Mr. Cudahy was for many years with Armour & Co. and the Armour Packing Co., both parts of the great packing interests of "Phil" Armour. Whether, as some say, "Armour made Cudahy," or *vice versa*, one thing is certain, and that is, that Mr. Cudahy, in branching out on his own account after his long experience with the great and only Armour, intimates thereby that there is money in the packing business.

During the month the final cash payment was made for the "Stickney tract" by the Chicago packers who rebelled at the recent settlement effected between the "Big Three" (Armour, Swift and Morris) and the Union Stock Yards Co., at Chicago; so that it becomes pretty certain that the other packers now at the Union Stock Yards will sooner or later remove their packing houses to the new yards, as they threatened and promised to do some two or three months ago.

PACKING HOUSE NOTES.

——The Chicago Packing and Provision Co. at Nebraska City, Neb., is to put in another ice machine.

——The American Refrigerator Transit Co. are building fourteen cars for the sole use of the Fort Worth (Tex.) Packing Co.

——The Fort Worth (Tex.) Packing Co. will materially enlarge their refrigerating capacity by adding new machinery during the winter.

——John P. Squire & Son, packers, of Boston, will put in a 150-ton De La Vergne refrigerating machine. The space to be refrigerated will be over 3,000,000 cubic feet.

——The new 150-ton machine built by Weisel & Vilter Manufacturing Co. for John Morrell & Co., Ltd., Ottumwa, Iowa, has been charged with ammonia by the National Ammonia Co., and started up.

——It is rumored at Sioux City, that Cudahy, the great Chicago packer, who also has houses at Omaha and Milwaukee, has leased the Booge plant in that city, and will begin operating it at once. Stock receipts at Sioux City this fall are larger than ever before.

——A number of large packing houses in both the east and west are putting in overhead tracks, switches, etc., for handling carcasses, made by J. W. Moyer, of Philadelphia. It is difficult to see how a packing house can handle carcasses conveniently and quickly without such apparatus.

——American beef growers are to have more and more competition from New Zealand. Two large cargo ships have just been completed to carry frozen meats from New Zealand to England: and in a recent trip they discharged 65,000 and 58,000 carcasses each. Several other vessels are also employed in the trade.

——M. Cudahy, the Chicago pork packer, has bought the plant of McLennan, Shallcross & Co., and the Magnolia plant of Hughes, Taggart & Co., Louisville, together with twenty-three acres of land. He will erect a big stock yard and pork packing establishment, and make that city his southern distributing point.

——Armour & Co., of Chicago, have just finished a large cooler at Toledo, Ohio, 180×69 feet, two stories high, which will be used to store meats received by refrigerator cars from the Chicago and Kansas City abattoirs of the firm. The Toledo people claim it is the finest establishment of the kind in the west outside of Chicago or Kansas City. It is cooled by ice stored in the second story.

——Messrs. Doud & Co., Boone, Iowa, are about to put an ice and refrigerating machine into their packing house. The ice machine will be of such capacity as to keep the packing house at the proper degree of coolness during the hottest weather, and in addition make from five to ten tons of block ice per day for icing cars. To accommodate the machine it will be necessary to erect an addition to the packing house some forty feet square and three stories high. This addition will contain the ice machine and its engine, together with a new engine and two additional large boilers for the use of the house.

——Traveling Agent John S. Knox, of the Cudahy Packing Co., of Chicago, Omaha and Milwaukee, has just left St. Louis after completing the details for the packing plant to be established in East St. Louis by his company, says a St. Louis telegram. It will be the largest plant in that city. At the time of his visit there Mr. Knox bought the plans of the buildings which his company proposed to erect, but did not make public their details nor, it is believed, did he close contracts for the work. The new plant is to cost $500,000, and will afford employment to several hundred men. The company will at first use the plant only for their beef packing business, but their plans contemplate finally the establishment of both beef and pork packing in East St. Louis.

FOREIGN NOTES.

——During the year passed the United States exported 45,000 tons of ice, valued at $112,000. Our best ice customers are the British West Indies, to which were exported during the year 18,000 tons, valued at $47,000. Somewhat singularly, the loudest calls for ice machines come from those very islands. The United States consul at Antigua invites the attention of American artificial ice companies to the splendid opening which that and all the other of the British West India islands present.

——The Northern Counties Ice Co., of Newcastle-on-Tyne, England, has recently erected a 25-ton ice machine and 18-ton refrigerating plant, at the grain warehouses, Quayside, the machinery having been built by the Pulsometer Engineering Co., Ltd., of London. The refrigerating rooms are so located as to facilitate the unloading from vessels of frozen meat from America, Australia and New Zealand. The machinery, ice tanks, etc., are located on the ground floor and the cooling rooms in the cellars underneath, while running through the building is a system of rails uniting with the railway tracks outside for loading cars with ice and meat under cover. The upper floors of the building being designed for grain storage, the boilers are located outside the main building, twenty feet above the ground level. The system of refrigeration is of the ammonia compression type, the warehouses being built under the Puplett's patents, owned by the Pulsometer Engineering Co., Ltd., but the cold storages are cooled by brine circulation, the cellars having four rooms, of 43,500 cubic feet capacity, insulated and fitted up for meat already frozen, which will be kept at 24° F., and several others of 30,500 cubic feet capacity, as well as 24,000 cubic feet of passage ways, to be kept at 35° F. The plant is worked by one main engine of compound, horizontal tandem type, the machines, though separate, being so arranged as to work in conjunction, giving 25 + 18 tons ice making or refrigerating capacity as desired. A high pressure engine is provided for running the refrigerating plant (18 tons) when the main engine is not at work. The gas compressors are of the horizontal, double-acting type, with valves of steel, working in steel vertical cases, and without springs or buffers. The stuffing box around the compressor rod is provided with an inner and outer packing, leaving an ammonia chamber around the rod, which chamber is connected by two pipes to a reservoir placed above the pump and filled with oil. Any gas passing the inner packing escapes into the reservoir, and a circulation of oil is set up. The top of the reservoir is connected with the suction of the pump, and any gas collecting in the reservoir is thus at once removed. The condensers are placed in a wrought iron tank, and consist of special wrought iron **U** tubes, connected with forged steel junction pieces, so arranged that any tube can be replaced. At the end of the ice tanks are placed the refrigerators, three in number—two for ice making and one for refrigerating the cellars. The design is multitubular, having welded steel shells and tube plates secured by bolts. The tubes are **U**-shaped and so arranged and fastened on the tube-plate that they can be withdrawn from the shell if desired. The liquid ammonia surrounds the tubes, and the brine is circulated through the tubes by brine pumps placed in the refrigerator tank. The refrigerators are placed in separate tanks, and not in the congealing tank, by which arrangement they are protected and readily accessible. The ice tanks are of wood, with a mold capacity of 75 tons, the molds being of galvanized steel and the blocks weighing about 175 pounds. The connecting ammonia pipes are of seamless steel, with valves of forged steel, and all parts exposed to the action of ammonia are also of wrought iron or steel, except the compression pumps, which are made in cast iron.

NEW COLD STORAGE PLANTS.

As in the department of ice factory construction, so also in cold storage building there is a commendable activity. Business men handling perishable food products are coming to understand better day after day the usefulness and practical value in a pecuniary way of these storage facilities, and their construction in new territory is to be noted almost daily; and, as will be seen in the notes below, the new factories are by no means confined to any one section, but are scattered all over the country. The record of new plants, enlargements, etc., is as follows:

INDIANA.

Terre Haute—The Terre Haute Brewing Co. will erect a large cold storage house.

IOWA.

Council Bluffs—The Anheuser-Busch Brewing Association will erect an extensive storehouse on Tenth Ave. during the winter. The plans have been prepared.

Emmettsburg—The Jos. Schlitz Brewing Co. will erect an ice house and storage depot here. This is the sixth house the company has established recently in Iowa.

Wilton—G. W. Kelley, of Sweetland, has purchased the abandoned brewery building, and will convert it into a creamery. He has cold storage, where he keeps his products fresh, and contemplates enlarging that department for the accommodation of the public, who need such facilities.

MAINE.

Cumberland Center—E. B. Osgood is putting up a cold storage house.

MICHIGAN.

Kalamazoo—Three Kalamazoo men will erect a big warehouse, and engage in the cold storage business on a large scale.

Saugatuck—It is proposed to build a cold storage warehouse and fish freezing plant here.

Sheboygan—The Cold Storage Co. will erect a three-story building on the river front. The company has incorporated as the Sheboygan Cold Storage Co. The capital stock is $10,000, and the incorporators are Peter Batts, G. Edward Hart and Pliny H. Peacock.

MINNESOTA.

Minneapolis—The Minneapolis Cold Storage Co. has been incorporated by Emerson Cole, E. G. Potter, Madison Cooper, C. E. Cotton and S. M. Rich; capital, $150,000; object of its business shall be cold storage, freezing, general storage, the loaning of money on merchandise while stored in the house; also cutting, storing, buying, selling and dealing in ice; also buying and selling all articles of merchandise.

MONTANA.

Great Falls—The Great Falls Meat Co. are erecting a cold storage house (ice system), and will make a specialty of handling frozen fish and poultry.

NEBRASKA.

Crawford—The Krug Brewing Co., of Omaha, is erecting a cold storage house, making three in that city.

NEW YORK.

Buffalo—The Buffalo Brewing Co. is at work on a three-story cold storage house; only one story, however, to be completed for the present.

OHIO.

Ashland—Ground has been broken for the new cold storage warehouse of John Houck Brewing Co. The structure will be 36×44 feet, two stories, of brick, and will cost over $3,000 when completed.

Greenville—Is to have another cold storage house. This is the third in the town used by brewing firms.

PENNSYLVANIA.

Emlenton—The Producers' Oil Co. has just closed a contract for a 20-ton refrigerating machine, made by the Craft Refrigerating Machine Co., which will be used in the paraffine works.

Reading—The Reading and Pottstown parties who organized a cold storage company, capital $100,000, with Burgess C. Q. Guldin, of Pottstown, president, have purchased a site at the corner of Reed and Elm streets, Reading, for their building, which is to contain two ice machines of improved make. Their capacity will be forty tons daily.

Towanda—The Messrs. Stegmaier are erecting a cold storage house to cool with ice.

TEXAS.

Dallas—The Texas Brewing Co. will increase the capacity of their refrigerating and ice making plant.

Greenville—The Fort Worth Brewing Association has completed arrangements for the erection of a beer and ice house at Greenville.

San Antonio—The San Antonio Cold Storage and Manufacturing Co. has been incorporated, with a capital stock of $50,000. The incorporators are C. H. Brewster, J. Ward and J. Shull; purposes, to purchase, can, refrigerate and sell meats, vegetables, etc.

Velasco—H. Hamilton, J. A. Patton, H. Prince and C. A. Zilker, of Houston, have incorporated the Velasco Ice, Light and Refrigerator Co., for the purpose of operating the ice factory and cold storage plant lately reported as to be erected. The capital stock is $50,000.

WISCONSIN.

Sugar Creek—A large ice house is in course of erection at the creamery.

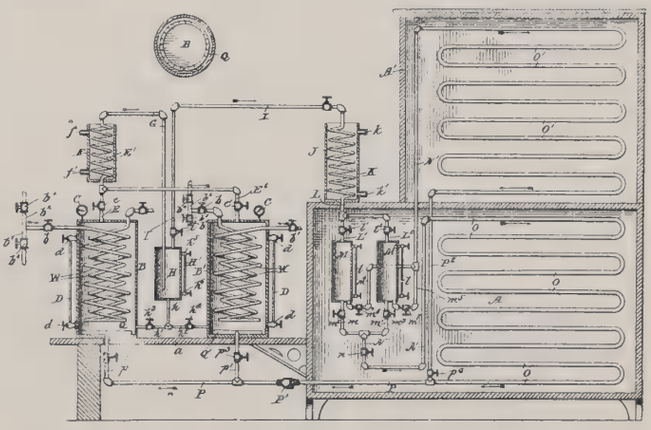


We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

REFRIGERATING APPARATUS.

No. 462,904. Charles F. Miller, Lancaster, Pa. Filed July 3, 1891. Serial No. 398,412. Patented November 10, 1891. (No model.)

Claim.—1. In a refrigerating apparatus, the combination of a pair of generators, with a cooler for the liberated gas, pipes and valves making communication at will between either one of the said generators and the said

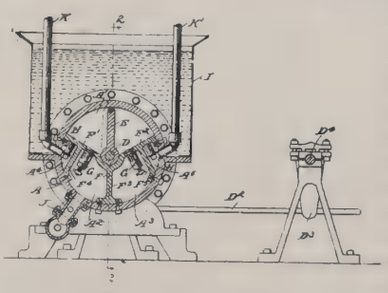


cooler, a separating receptacle receiving the gas and condensed steam from said cooler, and the necessary pipes and coils of a refrigerating circuit, substantially as and for the purpose set forth.

ICE MACHINE.

No. 464,862. Frank L. Fonda, Robert C. Roach and Walter H. Underwood, Hutchinson, Kan. Filed February 7, 1891. Serial No. 380,589. Patented December 8, 1891. (No model.)

Claim.—The combination, with the cylinder A, having removable head B, provided with aligned stuffing boxes, and a spider F, extending from end to end of the cylinder and formed of three radial arms F' F^2 F^3, arm F^3 being apertured, and narrower arms F^4 F^5 along the under side of the arms F' F^2, respectively, the outer edges of said arms being bolted to the cylinder, thus forming compression chamber A', connected inlet chambers A^2 A^3 and separate outlet chambers A^4 A^5, a supply pipe leading into

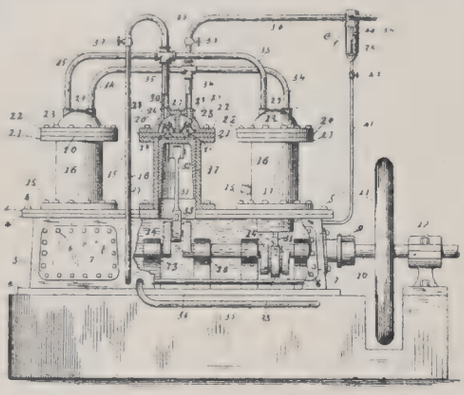


said inlet chambers, spring seated valves opening from chambers A^2 A^3 into the compression chamber, and outlet valves opening from opposite sides of chamber A' into the respective chambers A^4 A^5, of the rocking shaft extending through the compression chamber and stuffing boxes, and a piston or wing E, mounted on the shaft with its ends and longitudinal edges in close contact with the walls of said chamber, substantially as set forth.

PUMP AND ICE MACHINES.

No. 465,276. Frederick X. Kuhn, Buffalo, N. Y. Filed June 5, 1889. Serial No. 313,133. Patented Dec. 15, 1891. (No model.)

Claim.—In an ice machine, the combination of the oil receptacle, the cranked shaft mounted therein, the cylinders communicating with the receptacle, the pistons

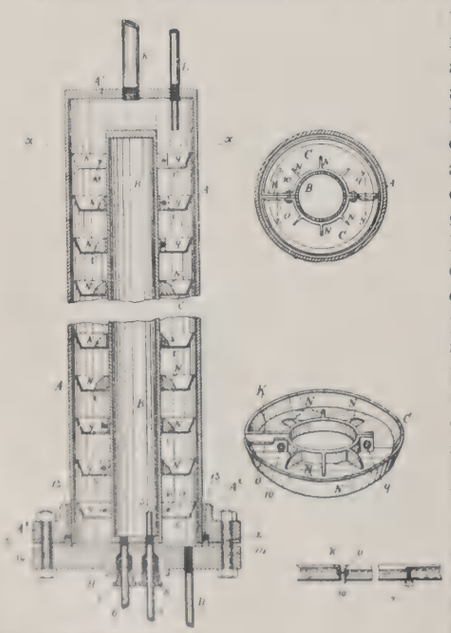


in said cylinder operated by the shaft, the dome-shaped divided valve cases on said cylinders, the force and suction valves in said cases, the suction pipes having the coil extending into the oil receptacle, and the force pipes having the branch, and the oil receptacle communicating with said branch pipe, all substantially as shown, and for the purpose described.

AMMONIA STILL.

No. 460,137. Daniel L. Holden, New York, N. Y. Filed March 23, 1891. Serial No. 386,002. Patented September 29, 1891. (No model.)

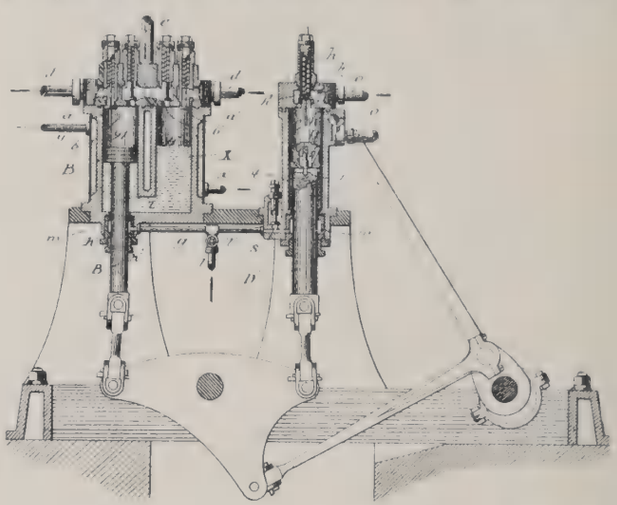
Claim.—The combination, in an ammonia still, of the case A, permanently closed at the one end and having the base at the other end and packing and clamping devices around such base, a hollow column closed at the ends, a supply pipe for fluid, and a discharge pipe connected with the bottom of the column and passing through the base, and packings around such pipes, and a range of pans connected to and supported by the column, substantially as set forth.



COMPRESSING APPARATUS.

No. 460,696. Franz Windhausen, Berlin, Germany. Filed January 8, 1889. Serial No. 295,798. Patented October 6, 1891. (No model.

Claim. In a machine for producing cold by the expansion of a gas liquefiable under mechanical compression, the combination, with a compressor having a chamber A, provided with a piston, a chamber A', communicating with the chamber A, and containing a pressure fluid X, confined between the piston and the stuffing box of the piston rod, of an expansion cylinder C, having a piston provided with a valve r, a space t around

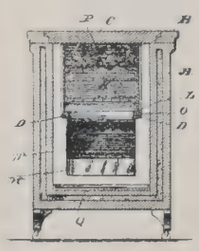


the piston rod, a valve s, and a space m' within the stuffing box of the piston rod and communicating with a space m in the stuffing box of the compressor, substantially as and for the purpose set forth.

REFRIGERATOR.

No. 460,808. William Campbell, New York, N. Y. Filed March 11, 1891. Serial No. 384,659. Patented October 6, 1891. (No model.)

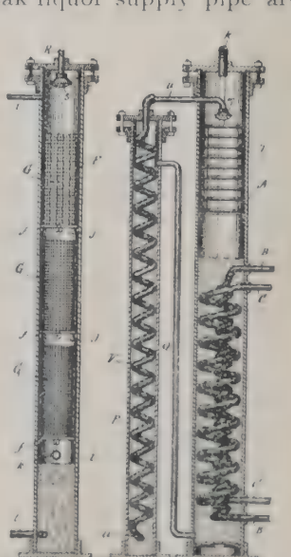
Claim.—In an ice chest, the combination with an elongated chest having an opening in its top at one end thereof, of looped straps D, secured to the top on opposite sides of the opening, formed with angular securing portions E, and extending down into the chest, a metallic box having flanges at its top and bottom, the former resting on the securing portions and the latter on the lower portions of the straps and formed with an aperture P in its upper side, a drip chamber M, having flanges on its upper edge, resting on the straps, an inclined side N, its lower end being contracted, a drip pan and an ice tray in the box, substantially as described.



ICE MACHINE.

No. 462,689. Oliver H. Castle, Indianapolis, Ind. Filed August 4, 1890. Serial No. 360,900. Patented November 10, 1891. (No model.)

Claim.—1. In an ice machine, the combination, with the absorption chamber, and a weak liquor supply pipe arranged to enter the upper part of said chamber, of a weak liquor distributer consisting of a coil of wire cloth or like perforated material supported in said chamber above its bottom and below said weak liquor supply pipe, whereby the weak liquor is distributed in thin films, as and for the purpose set forth.

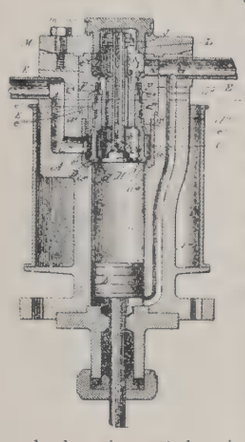


2. In an ice machine, the combination with the absorption chamber and a weak liquor supply pipe arranged to enter the upper part of said chamber, of a weak liquor distributer consisting of a series of coils of wire cloth or like perforated material, said coils being supported in said chamber above its bottom and below said weak liquor supply pipe, said coils each forming a series of vertical passages, and ar-

ranged with a transverse open space between adjacent coils, substantially as set forth.

GAS COMPRESSOR.

No. 461,080. George F. Knox, Chicago, Ill. Filed May 2, 1890. Serial No. 350,289. Patented October 13, 1891. (No model.)



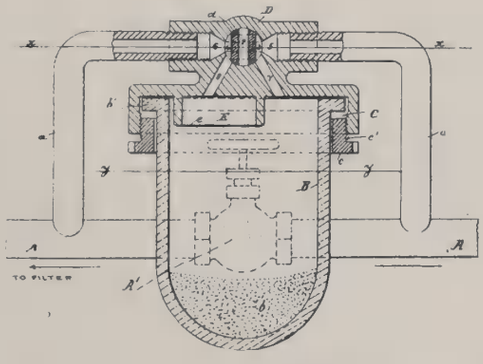
Claim—1. In a gas compressor, the combination, with the compression chamber and piston, of a valve having a tubular stem, a block having an annular socket in which said stem fits, and a duct communicating with said socket a short distance away from its closed end, so as to be closed by the valve stem before it completes its stroke, whereby the valve is cushioned by air confined in the socket of its stem, substantially as set forth.

2. In a gas compressor, the combination, with the compression chamber and piston, of a valve *D*, having a suitable stem, the block *E*, having a socket for said stem, and the ring *C*, having the valve seat *c*, said block and ring being detachably secured together, substantially as set forth.

DEVICE FOR FEEDING CHEMICALS TO FILTERS.

No. 461,235. Thomas H. Butler, Baltimore, Md. Filed February 25, 1891. Serial No. 382,780. Patented October 13, 1891. (No model.)

Claim.—The combination, with the shell of the valve, provided with the passages 5 6 and 7 8, and adapted to be secured to the inlet pipe of a filter, of a jar adapted to contain a chemical substance, and con-



nected with the said passages 7 and 8, and the plug provided with the passages 2 3 4, whereby the water may be passed into the filter direct through the inlet pipe and the central passage 2 of the plug, or indirectly through the said jar and the passages 7 and 8, substantially as set forth.

WANTED AND FOR SALE ADVERTISEMENTS.

(The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.)

A Rare Chance.

A 3 ton Boyle ice machine in good condition. Price low. Address E. K. P. OSBORN, Birmingham, Ala.

Location for Ice Plant and Cold Storage.

Wanted, location for ice plant and cold storage. Address all communications to "R. S. D.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

For Sale Cheap.

First-class ice elevator. Capacity 1,800 tons daily, with 700 feet chain and hold bar pockets all complete. Address JAMES A. SMITH, 4708 South Broadway, So. St. Louis, Mo.

Wanted.

First-class erecting engineers for Corliss engines and refrigerating and ice making machinery. Address "Z. M.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Condenser for Sale.

For sale, a submerged condenser used only one season, consisting of 8,500 feet of one-inch pipe. Will be sold at a bargain. DIAMOND ICE COMPANY, Wilmington, Delaware.

Situation as Engineer.

Situation as engineer of ice plant. Four years' experience with absorption and compression machines. Can give good references. Address WILL M. MOORE, box 77, Yazoo City, Miss.

Manager Wanted.

An experienced manager to take charge of our new 125-ton (Smith Plate) ice plant and cold storage warehouses. Must be a man of ability, and expert in cold storage business. A good situation for the proper party. Best of references required. Address W. S. HODGES, Secretary, room 37, Republic Building, St. Louis, Mo.

Ice and Cold Storage Plant for Sale.

The Excelsior ice and cold storage plant, located in the solid and progressive city of Nashville, Tenn. Ice making capacity 80 tons daily, and an additional reserve capacity of 20 tons, cold storage capacity 50,000 cubic feet. This is one of the largest and best equipped plants of the kind in America, and has been a success in every way from the start. For particulars address W. H. HOWE, Nashville, Tenn.

Refrigerating Machinery for Sale at a Bargain.

Having closed up business, a cold storage house desires to sell its entire machinery, consisting of three (3) ice or refrigerating machines, aggregating fifty (50) tons capacity; two (2) Harris Corliss engines, 96 and 66 horse power, nearly new; one (1) Whittin boiler, 75 horse power; four (4) Sturtevant blowers, coils, shafting, etc., all in good condition. Will be sold in one lot or to suit purchasers. Address G. A. BIGELOW, 116 North st., Boston, Mass.

E. H. COOK CO. LIMITED.

ENGINEERS AND CONTRACTORS FOR

Ventilating

WATER AND . . .
STEAM HEATING.

ALSO EXPERTS IN

Brewery and Refrigerating

. . . WORK . . .

GREENHOUSE HEATING
AND STEAM LAUNDRY WORK.

PUMPS

Damper Regulators, Feed Water Heaters, and all kinds of Engineers' Supplies.

Nos. 92 and 94 Andrews Street,

ROCHESTER, N. Y.

Everybody Who Uses Ice Machinery

The best and cheapest blacks on earth, all grades and for every purpose. We supply the largest makers and users of Ice Machinery in the world. Write us if you want prices and further pointers.

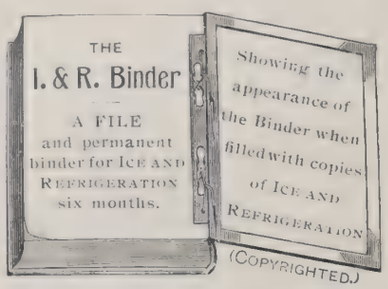
NEEDS BONNELL'S NUBIAN IRON ENAMEL

THE NUBIAN IRON ENAMEL CO., 17 TO 19 NUBIAN AVENUE, (A CHICAGO SUBURB.) CRAGIN, ILL.

THE

I. & R. BINDER

FOR 1892



Save your COPIES OF Ice AND Refrigeration

FOR FUTURE REFERENCE.

EACH VOLUME IS FULLY INDEXED AND MAKES A VALUABLE WORK OF REFERENCE.

Binders holding six copies (one volume), $1.00 each, post-paid.

ADDRESS **H. S. RICH & CO.**, PUBLISHERS,
177 La Salle Street, CHICAGO.

CRANE COMPANY, CHICAGO.

SPECIAL **WROUGHT IRON PIPE**

. . . . . For Ice Making and Cold Storage.

HILPERT & CHANDLER

ENGRAVERS
BY ALL PROCESSES.
REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.
167 DEARBORN ST., CHICAGO.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice AND Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,
CHICAGO.

AMMONIA ROD PACKING

Saves Fuel — **ANTI-FRICTION METALLIC PACKING** — Frictionless

CHEAP LASTS FOR YEARS CHEAP

AT LAST A PACKING HAS BEEN INVENTED THAT WILL PACK AMMONIA RODS

Satisfactorily and Economically.

ALL KINDS OF PISTON RODS PACKED.

ILLINOIS METALLIC PACKING CO.
103 TRADERS' BUILDING,
Send for Price List and Description. CHICAGO.

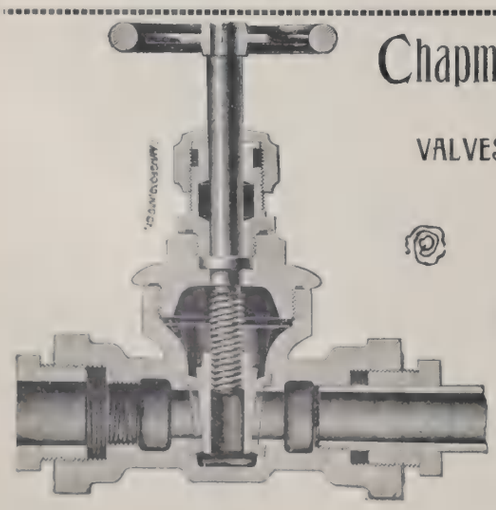
READ WHAT ONE OF OUR CUSTOMERS SAYS.

CHICAGO, December 12, 1891.

ILLINOIS METALLIC PACKING CO., CHICAGO.

GENTLEMEN: In reply to yours of recent date, am glad to be able to state that the Ammonia Rod you packed with your Anti-Friction Metallic Packing is running very satisfactory. ***After a trial of a number of other packings on this rod,*** none of which were a success, I can truthfully state that I ***consider your packing as being unequaled for ammonia rods, as well as for other rods, pumps and engines.*** Wishing you the success you deserve with your packing, I am,

Yours respectfully,
CHAS. B. FAIR, Chief Engineer,
CONSUMERS' PURE ICE CO.



Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

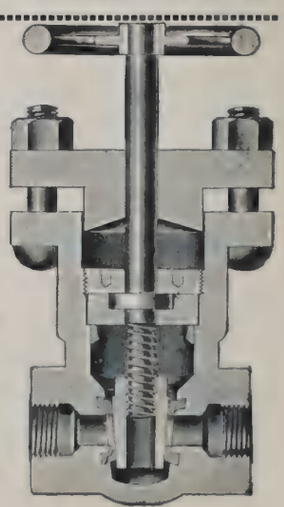
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works,
INDIAN ORCHARD, MASS

Treasurer's Office,
72 Kilby and 112 Milk Sts.
BOSTON, MASS.



THE F. L. GALIGHER COMPANY,

ICE and REFRIGERATING MACHINE SUPPLIES

Machines Purchased, Erected and Results Guaranteed.

CAPACITY OF PLANTS INCREASED
AT A MINIMUM COST.

Repairs and Alterations Made.

. Perfected Distilled Water Apparatus for Ice Factories Pure Water Co.'s, Chemists, and Caraffe Freezing.

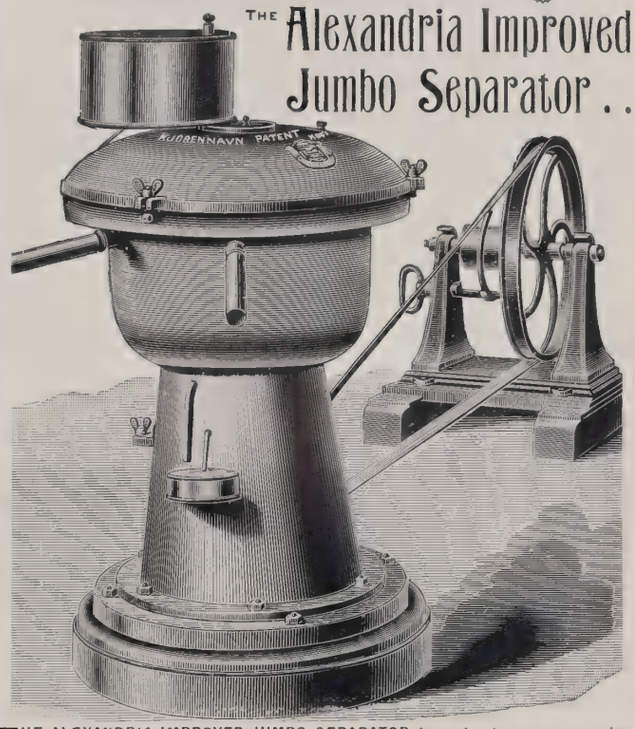
EXPERTS FURNISHED. CORRESPONDENCE SOLICITED.

ROOM 709
CHAMBER OF COMMERCE BUILDING,
CHICAGO, ILL.

BRANCH OFFICE, N. W. COR. THIRD & MAIN STS., CINCINNATI.

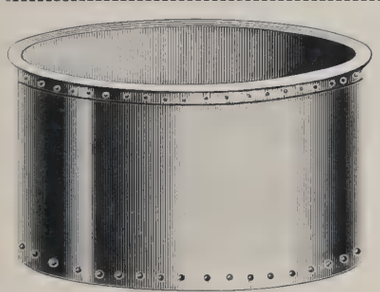
ATTENTION, CREAMERIES!!!

THE Alexandria Improved Jumbo Separator . .



THE ALEXANDRIA IMPROVED JUMBO SEPARATOR has the largest capacity of any machine in the world, with this size bowl, viz.: 15. With a speed of 6,500 revolutions per minute it will separate 2,500 to 3,000 lbs. per hour. Two horse power will run it. We guarantee this machine in every respect; material, workmanship and separation of cream perfect. The bowl of this separator is forged from steel made especially for this machine. If you need a large separator, call on us. We control the Nelson & Peterson and the Stephens Patent for the U. S. of the Alexandria and Jumbo Separators.

DAVIS & RANKIN BLDG. AND MFG. CO.
240 TO 254 WEST LAKE STREET, CHICAGO.



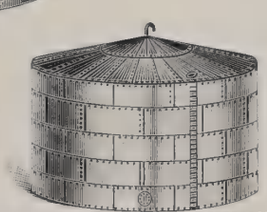
WM. GRAVER TANK WORKS.

INCORPORATED

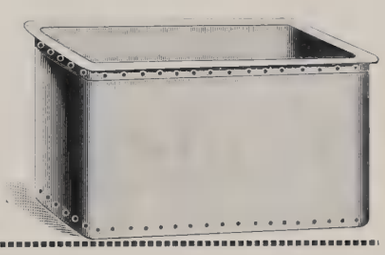
MANUFACTURERS OF.....

IRON AND STEEL **STORAGE TANKS**

WORKS:
EAST CHICAGO, IND.
ON BELT LINE, CONNECTING WITH ALL CHICAGO RY'S.



OFFICES
334 & 336 Rookery,
CHICAGO, ILL.



GROUND CORK

FOR INSULATING PURPOSES.

For Cold Storage Rooms, Refrigerator Cars, Brewers, and all insulating purposes. Large stock on hand which will be moved at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non conductor of heat in all dry storage rooms and situations. They are FIRE-PROOF, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, 125 Tons daily. Big Spring Ice Co.
Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER.
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice.
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

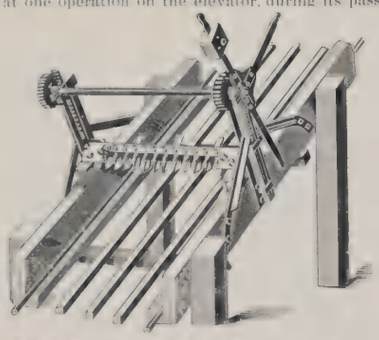
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house. It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

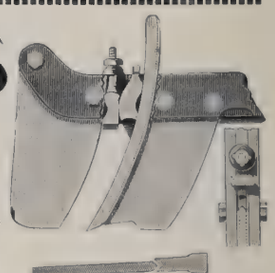


CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

ICE TOOLS



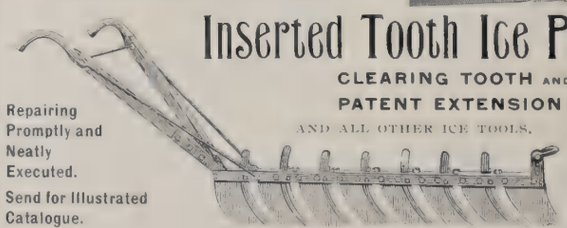
HENRY BODENSTEIN,
MANUFACTURER,
Staatsburg, Dutchess Co., N. Y.

MANUFACTURER OF THE PATENT

Inserted Tooth Ice Plows

CLEARING TOOTH AND PATENT EXTENSION GAUGE

AND ALL OTHER ICE TOOLS.

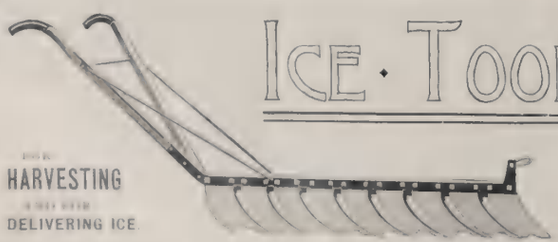


Repairing Promptly and Neatly Executed.

Send for Illustrated Catalogue.

All Work Warranted to Give Satisfaction

ICE TOOLS



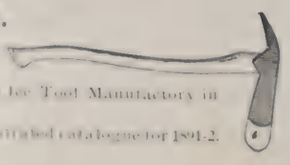
FOR HARVESTING AND DELIVERING ICE

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.

Send for illustrated catalogue for 1891-2.

PETER GERLACH & CO.

CLEVELAND, OHIO.

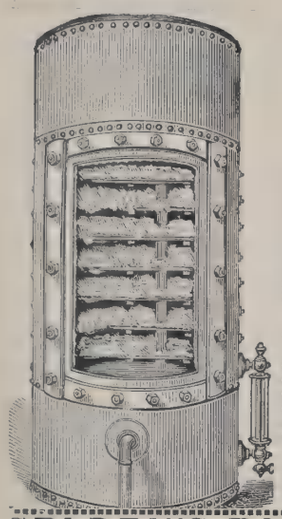
MANUFACTURERS OF THE FINEST

ICE TOOLS

.....FOR.....

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.

SEND FOR PRICE LIST.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

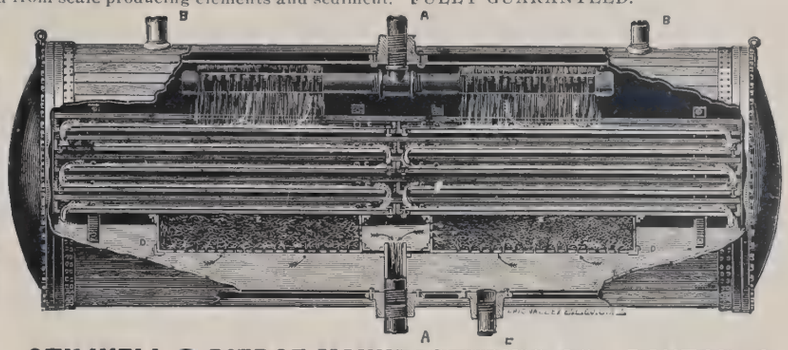
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

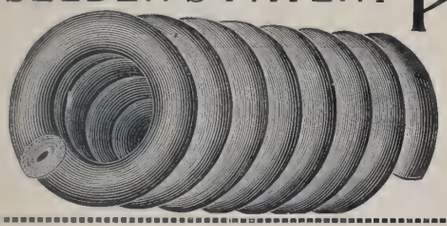
ESTABLISHED IN 1866.....



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

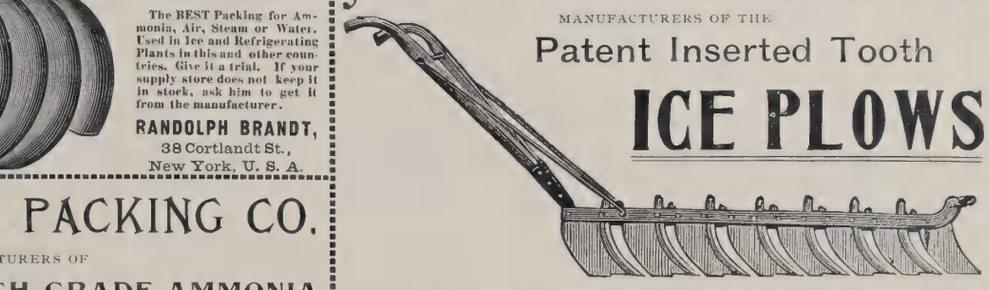
RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

J. G. BODENSTEIN & CO.

MANUFACTURERS OF THE

Patent Inserted Tooth

ICE PLOWS



OLD STYLE PLOWS, AND ALL OTHER ICE TOOLS

Before purchasing elsewhere send for our descriptive catalogue and price list.

STAATSBURG, N. Y.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

69 FRANKFORT,

CLEVELAND, OHIO.

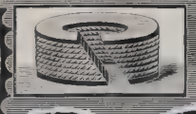
THE GARLOCK PACKING CO.

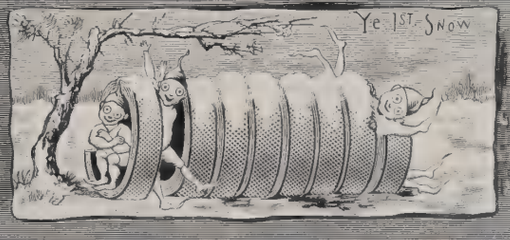
ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS

ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL GASES

EQUALED BY NONE







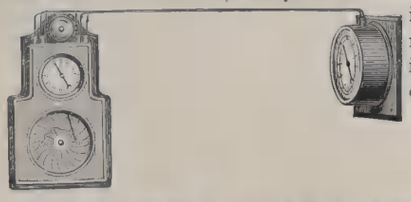


PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54.5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22&24 N. 4th ST. | PORTLAND, ORE.

WHERE PACKINGS ARE USED

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.

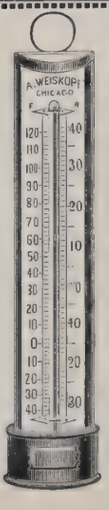


FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

.....MANUFACTURER AND IMPORTER OF.....

THERMOMETERS AND HYDROMETERS.

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.





The "STEAM JACKET"
BOILS THE WATER.

WM. BARAGWANATH & SON,

48, 50 & 52 WEST DIVISION STREET,

CHICAGO.

MANUFACTURERS OF . . .

EXHAUST FEED WATER HEATERS
LIVE STEAM FEED WATER PURIFIERS
POWER PUMPS, ETC., ETC.

SEND FOR CIRCULARS.

DUNLEVY
SHEET IRON WORKS

Galvanized Iron . . ICE CANS



And all Sheet Iron Tank Work for ICE FACTORIES.
WRITE FOR ESTIMATES.

515 NORTH LEVEE, ST. LOUIS.

SEIBEL-SUESSDORF
COPPER AND IRON MFG. CO.
MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

ST. LOUIS, MO.

WINGATE & MELL,

MANUFACTURERS OF : : : ICE CANS

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, ATLANTA, GA.

THE CANTON STEEL ROOFING CO.

.....MANUFACTURERS OF.....

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

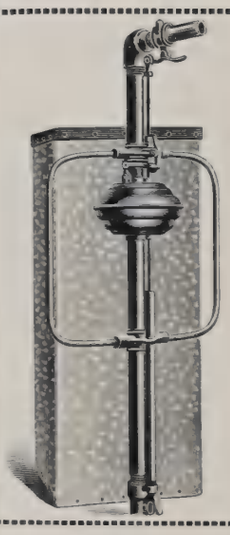
Canton, Ohio.

E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler



Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.

J. M. WESTERLIN. ALLAN CAMPBELL.

WESTERLIN & CAMPBELL,

Consulting Engineers & Contractors

FOR

ICE MAKING AND REFRIGERATING MACHINERY,

26 West Lake Street, Room 11,

CHICAGO.

AMMONIA FITTINGS AND ICE MACHINE SUPPLIES. PIPE WORK, REPAIRS, TESTS AND ALTERATIONS A SPECIALTY.
PLANS, SPECIFICATIONS AND ESTIMATES PROMPTLY FURNISHED.

IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, *HOT* or *COLD*, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on *Water Treatment.*

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.

KEYSTONE CHEMICAL CO. COVINGTON, KY., June 27, 1891.

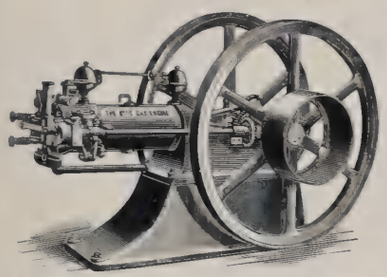
Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate

Yours truly,
(COPY) R. W. DUGAN, Sup't and Treas. CHAMPION ICE MFG. & COLD STORAGE CO.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

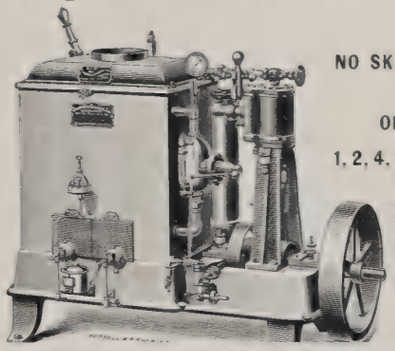
Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

THE

Shipman Automatic Steam Engine



NO SKILLED ENGINEER.

KEROSENE, PETROLEUM OR NATURAL GAS FUEL.

1, 2, 4, 6 and 8 HORSE POWER.

The most reliable, economical and satisfactory power for small

REFRIGERATING MACHINES. CREAMERIES. PACKING HOUSES, BOTTLERS. COLD STORAGE, Etc.

Send for Catalogue.

SHIPMAN ENGINE CO., 328 Summer Street, Boston, Mass.

CAPACITY 300 PER DAY.

ICE and "CANS" GALVANIZED IRON

WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE. READ TESTIMONIALS.

WRITE FOR PRICES



NEWBURGH, N. Y., November 29, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL.
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110 X 210 FT.

Established 1861. Incorporated 1890.

THE

KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

WRITE FOR SAMPLES AND FULL PARTICULARS ON

BEST INSULATING MATERIAL



For ·:

COLD STORAGE WAREHOUSES,
AND REFRIGERATOR CARS,
ICE HOUSES, AND ALL REFRIGERATION

EXTENSIVELY USED AND HIGHLY ENDORSED BY EXPERTS.

NEPONSET WATER-PROOF FABRICS

F. W. BIRD & SON, SOLE MANUFACTURERS, East Walpole, Mass.

Mineral Wool

BEST INSULATOR FOR . . . . .

ICE HOUSES,
COLD STORAGE ROOMS,
ETC.

REFERENCES ON APPLICATION.
SAMPLES FREE. . . . . .

U. S. MINERAL WOOL CO.

2 CORTLANDT ST., N. Y. CITY.

BIRD'S SHEATHING

ESPECIALLY PREPARED FOR USE IN

REFRIGERATORS AND COLD STORAGE

THE ONLY WATERPROOF ... INSULATING PAPER

That will not Deteriorate with Age.

SEND FOR SAMPLES AND PRICES.....

THE BIRD PAPER MFG. CO., 149 & 151 Church St. NEW YORK.

Insulating Linings

EVERY VARIETY FOR

REFRIGERATORS, REFRIGERATOR CARS AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

P. & B. WATERPROOF INSULATING PAPERS . . .

TRADE P & B MARK REGISTERED

ARE THE BEST MADE.

They contain **no tar,** are **odorless** and **clean to handle,** made from the best of paper stock; used by the largest and most prominent cold storage and refrigerating plants in the **world.**

P. & B. PRESERVATIVE COMPOUNDS

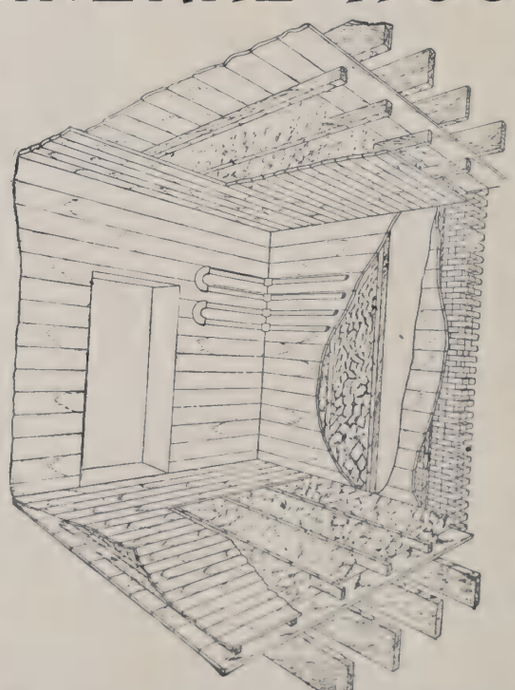
For insulating **walls** and preserving all kinds of **iron** and **wood work** exposed to **dampness,** acids or alkalies. The material is very **penetrating,** always remains **elastic,** will not chip or peel off. We also manufacture a heavy waterproof canvas material thoroughly **saturated** with our P. & B. Preservative Compound. This Material is a perfect **insulator,** strong and very durable.

STANDARD PAINT CO., SOLE MANUFACTURERS,

2 LIBERTY STREET, NEW YORK.

MINERAL WOOL

COLD STORAGE, BREWERIES



INSULATION

ICE PLANTS AND REFRIGERATORS.

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

ARNOLD & CO



CONESTOGA CORK WORKS. LANCASTER. PA.

NEW YORK SALESROOM, 67 MURRAY ST.

MANUFACTURERS OF ALL KINDS OF MACHINE CUT CORKS

Granulated Cork For Insulating Purposes

Our productions were awarded the First Premium at the Great Centennial for Uniformity and Quality. . . . .

GIVE US A TRIAL ORDER AND BE CONVINCED.

ADDRESS ALL COMMUNICATIONS TO . . . . . CONESTOGA CORK WORKS, OR TO ARNOLD & CO.

B. G. DODGE

MANUFACTURER OF EVERY DESCRIPTION OF MACHINE-CUT CORKS

FOR INSULATING PURPOSES A SPECIALTY

GRANULATED CORK



PROPRIETOR OF LANCASTER CORK WORKS

LANCASTER, PA.

ARMSTRONG, BRO. & CO.

INCORPORATED

MANUFACTURERS OF GRANULATED CORK FOR

INSULATING PURPOSES

THE MOST PERFECT AND DURABLE INSULATING MATERIAL KNOWN FOR FILLING ICE HOUSES, REFRIGERATORS, COLD STORAGES ETC.

ALSO MANUFACTURERS OF

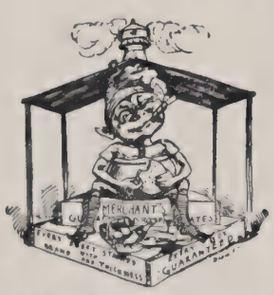
MACHINE CUT CORKS COMPRESSED POPLAR BUNGS, PLUGS AND TAPS.

FOR PARTICULARS AND ESTIMATES ADDRESS

ARMSTRONG BROTHER & CO. INCORPORATED, PITTSBURGH, PA.
THE ARMSTRONG BROTHERS CO. NEW YORK.
FAY-ARMSTRONG CORK CO. CHICAGO.
ARMSTRONG-GILBERT CORK CO. ST. LOUIS.

THE STAR VENTILATOR

MADE OF GALVANIZED IRON, COPPER OR BRASS



Write for Prices and Discounts.

For ventilating Mills, Factories, Foundries, Breweries; also Churches, School Houses, Theatres, in fact *all kinds* of buildings, there is *none equal to the "STAR."*

A cheap Ventilator, which will not do the work required, is *costly at any price.* Our claim for *superiority* of the *"STAR" VENTILATOR* is based on *merit* only; we believe the *first cost* to be a *secondary consideration.*

GALVANIZED SHEET IRON Patent Leveled. Guaranteed Free from Buckles.

CORRUGATED IRON For Siding or Roofing. Galvanized and Painted. . . . .

MERCHANT & Co.

PHILADELPHIA. NEW YORK. CHICAGO.
KANSAS CITY. LONDON.



Ice and Refrigerating Machinery

OILS

JAS. DALZELL & SON CO. PITTSBURGH, PA.



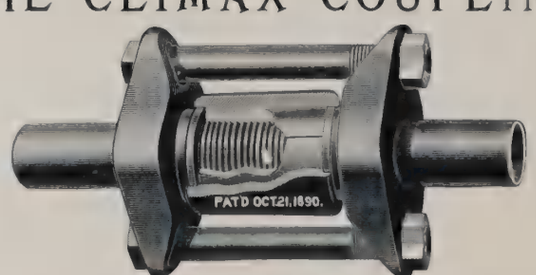
P. J. CONROY & CO.

75th St. and Island Road,
PHILADELPHIA.

CONROY MANUFACTURERS OF THE
Refrigerator Door Fasteners
PATENTED DECEMBER 5, 1885.

Which are rapidly supplanting all others. The only fastener that forces the door open as well as shut.

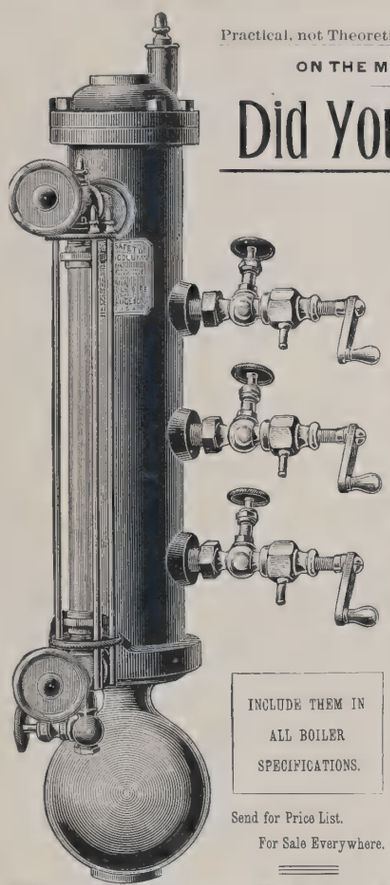
THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.

Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,
229 FULTON STREET,
SAN FRANCISCO, CAL.



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.
For Sale Everywhere.

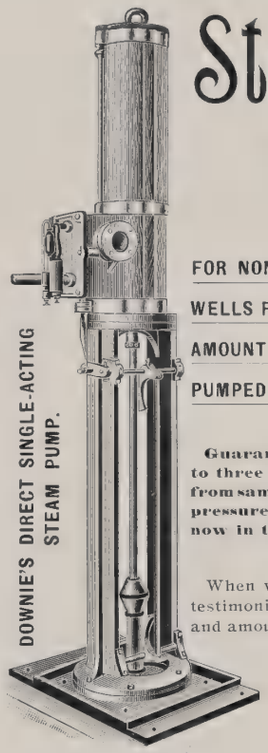
The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.
101 EUCLID AVE., CLEVELAND, O.

DOWNIE'S

DIRECT, DOUBLE-ACTING

Steam Pump



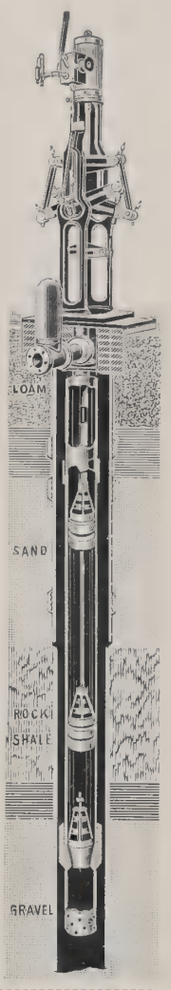
DOWNIE'S DIRECT SINGLE-ACTING STEAM PUMP.

FOR NON-FLOWING ARTESIAN WELLS FROM WHICH A LARGE AMOUNT OF WATER IS TO BE PUMPED . . . . . .

Guaranteed to lift from two to three times as much water from same well and same steam pressure as any other Pump now in the market.

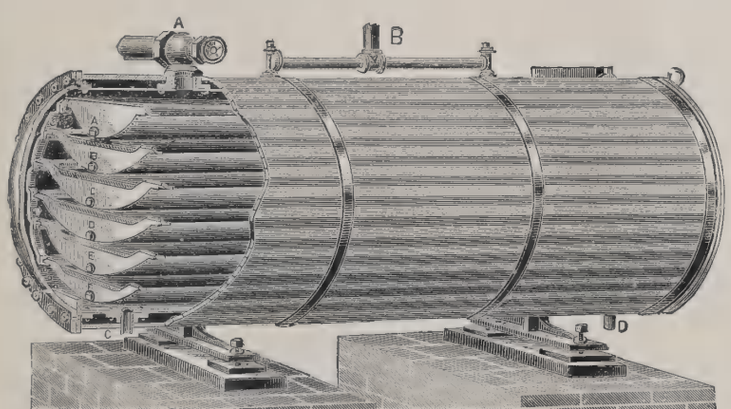
When writing for prices and testimonials, give depth of well and amount of water wanted.

Sole Patentees and Manufacturers,



Downie Bros. & Nevin, Limited

NEW BRIGHTON, PA.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

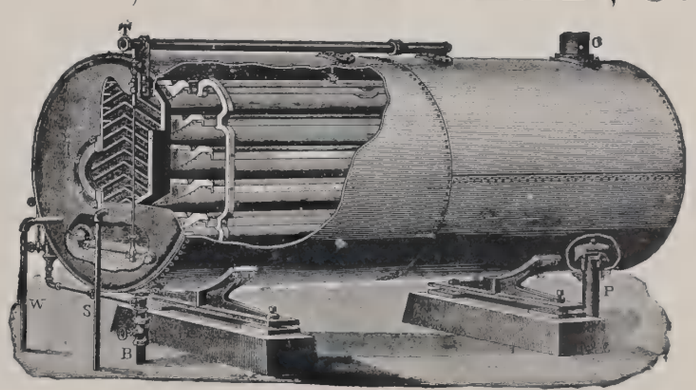
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT
OF YOUR EXHAUST STEAM,
INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

THE B. F. GOODRICH CO.

AKRON RUBBER WORKS,
AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

HOSE OF HIGH QUALITY FOR ICE FACTORIES AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds,
Belting, Valves, Etc.

SPECIALTIES TO ORDER. Samples and Prices upon Application.

....THE....
HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,
48 EXCHANGE PLACE, - - - NEW YORK.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY
Omnibus and Wagon
MFG. CO.
Builders of all Kinds of Vehicles.
Cor. Charles and Plum Sts.,
CINCINNATI, O.



PHOSPHOR-BRONZE
INGOTS, CASTINGS, WIRE, SHEET &c.
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND SOLE MAKERS OF "ELEPHANT BRAND" PHOSPHOR-BRONZE

AUG. MARITZEN,

Engineer and Architect

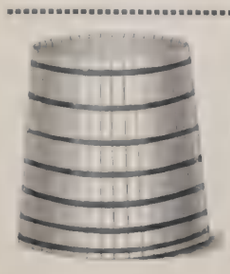
WILL FURNISH ON SHORT NOTICE
ALL PLANS, SPECIFICATIONS AND
ESTIMATES FOR COMPLETE . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE.
Chicago, Ill.

BEST OF REFERENCES FURNISHED AND SATISFACTION GUARANTEED. . . . . .

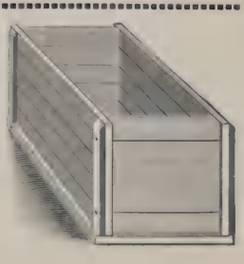


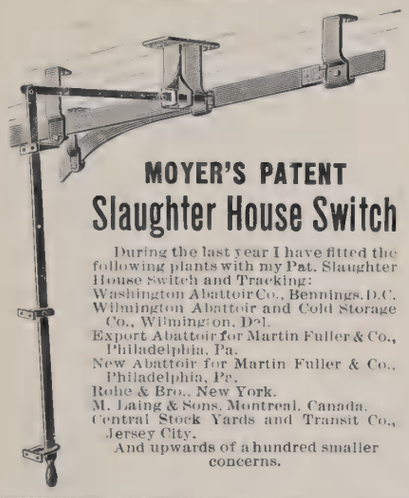
GEO. WOOLFORD,
Manufacturer of all kinds of
Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES,
COLD STORAGE HOUSES
RAILROADS, PACKERS,
CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





MOYER'S PATENT

Slaughter House Switch

During the last year I have fitted the following plants with my Pat. Slaughter House Switch and Tracking:
Washington Abattoir Co., Bennings, D.C.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
Export Abattoir for Martin Fuller & Co., Philadelphia, Pa.
New Abattoir for Martin Fuller & Co., Philadelphia, Pa.
Rohe & Bro., New York.
M. Laing & Sons, Montreal, Canada.
Central Stock Yards and Transit Co., Jersey City.
And upwards of a hundred smaller concerns.



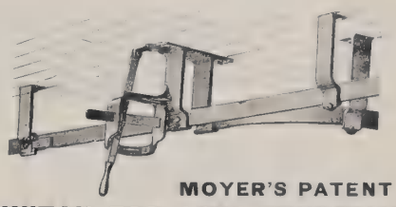
When using this Hanger the track is not required to be drilled, as it is held in position by a clamp bolt, thereby saving the cost of drilling. It affords a cheap and simple manner of erecting the tracking.

J. W. MOYER,

14 SOUTH BROAD STREET, PHILADELPHIA, PA.

MANUFACTURER OF

Overhead Tracking Switches AND Trolleys for Abattoirs, Refrigerators and Packing Houses



MOYER'S PATENT

SWITCH FOR LOW TRACKING.

Generally used where quarters of beef, hogs, or sheep are stored, and can be set up in any part of the room. It is fitted up and put together at the factory, so all that is necessary to erect it is to fasten the hanger to the ceiling and the switch is ready for use. This can be done in twenty minutes.

THE MIAMI VALLEY BOILER CO.

DAYTON, OHIO.



We guarantee all work to be first-class and prompt.

ESTIMATES GIVEN.

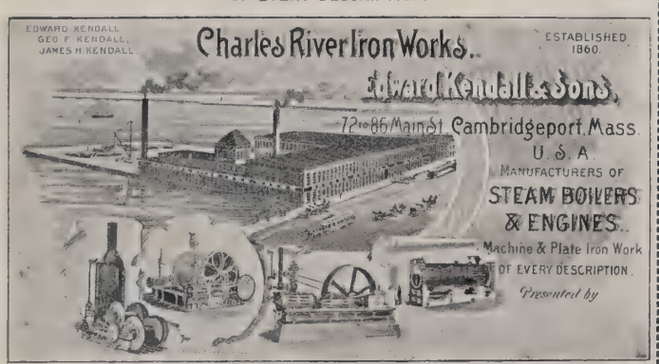
PLEASE ASK FOR PRICES.

BUILDERS OF

Stand Pipes, Boilers and Ice Tanks.

TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.

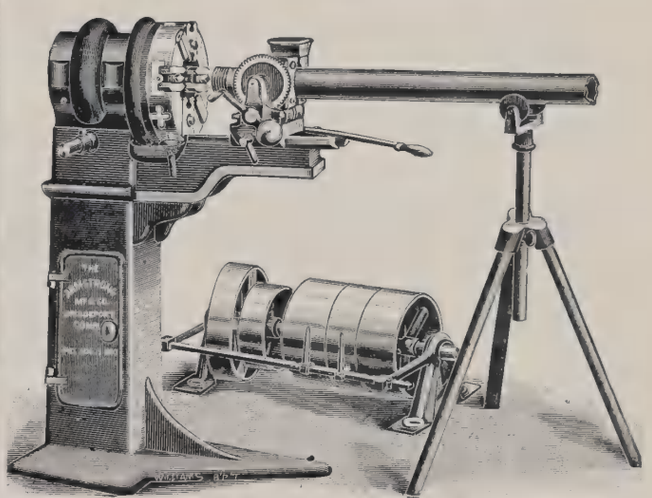


CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.

ARMSTRONG MAN'F'G. CO.





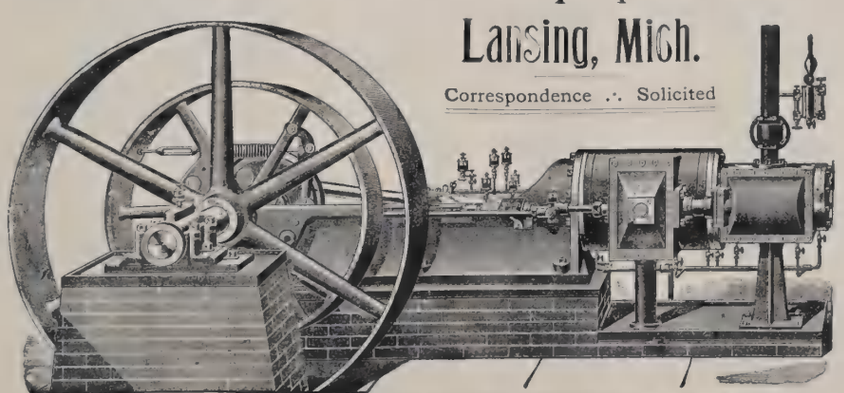
Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

LANSING IRON AND ENGINE WORKS

Lansing, Mich.

Correspondence .·. Solicited



[BACK VIEW TANDEM COMPOUND ENGINE, MADE BY THE LANSING IRON AND ENGINE WORKS.]

MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC

ENGINES

Boiler, Sheet Iron and Tank Work for Ice Factories and Cold Storage Plants a Specialty . . . . . .

REDUCING VALVES



Thousands of our Reducing Valves are used by all the largest railroads, sugar refineries, breweries, and steam plants in this and other countries We make a special Iron Reducing Valve for Ammonia. We also manufacture other steam regulating devices. . .

MASON REGULATOR CO. Boston, Mass.

ATTENTION

ICE MACHINE MAKERS, BREWERS AND EVERYBODY INTERESTED IN . . . .

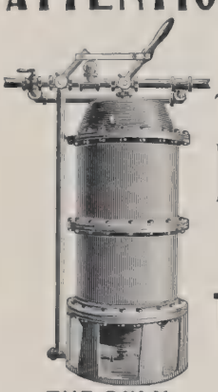
FILTRATION OF WATER

SHOULD KNOW THAT

THE LOOMIS

Improved Water Filter

IS THE ONLY WATER FILTER WHICH CAN PERFECTLY CLEANSE ITSELF.



THE ONLY Perfect Water Filter.

The Loomis Improved Filter Co.

43 S. Holliday Street, BALTIMORE.

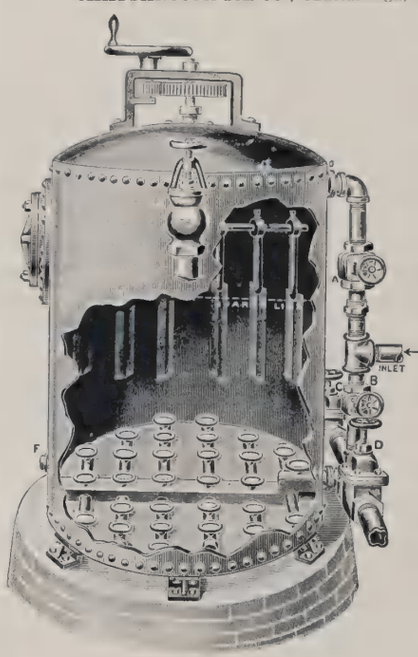
New York Office, 111 Broadway, Trinity Building.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST., CHICAGO.

REFER BY PERMISSION TO

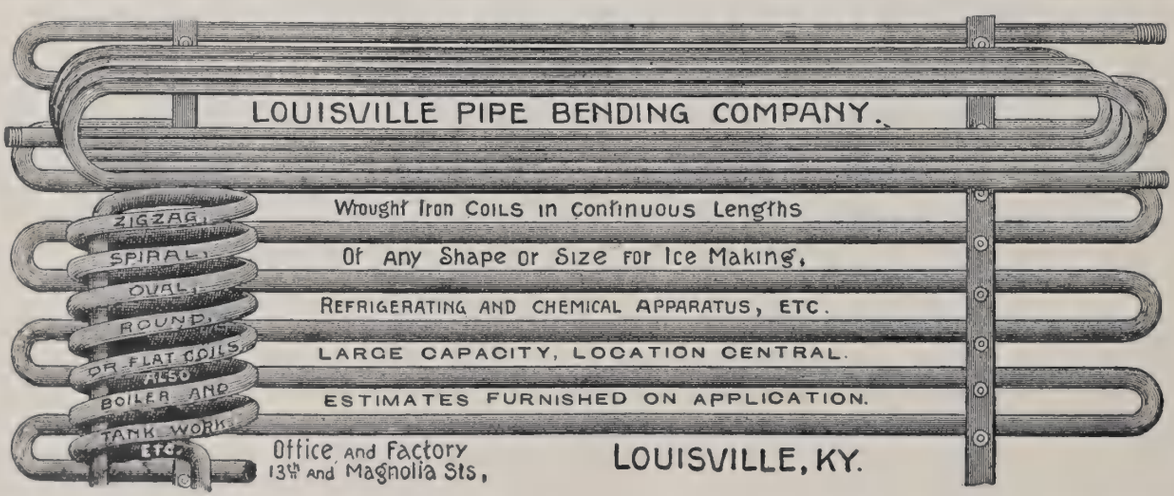
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.



BY USING THE D·D·D·

BUHRING WATER PURIFYING SYSTEM

ICE FACTORIES

WILL CONSTANTLY HAVE

ELEGANT PURE ICE . . . . . .
VAST SAVING IN COAL AND BOILERS
ABUNDANCE OF WATER, PURE AND WITHOUT COLOR.

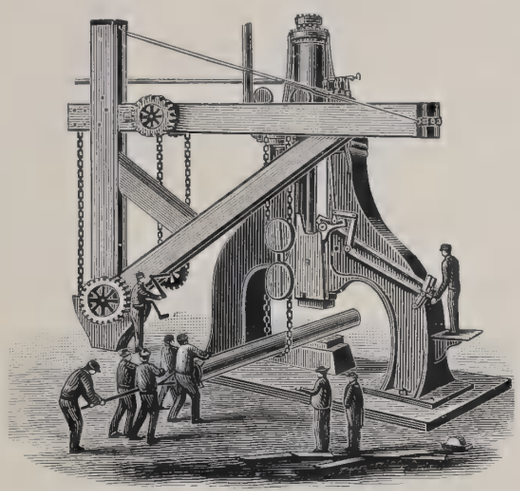
We make a specialty of purifying water without aid of chemicals in any form whatever, for the purpose of manufacturing artificial ice. The only system that eliminates such impurities as silicate, iron, bacteria, and all matter in physical solution, and is a perfect deodorizer and decolorizer.

FOR PARTICULARS, REFERENCES, AND ESTIMATES, ADDRESS

BUHRING WATER PURIFYING CO.

1389 Broadway, NEW YORK.

PIPE WELDING BY ELECTRICITY



THE SAMSON STEAM FORGE Co

OFFICE AND WORKS, CORNER Sacramento and Carroll Aves., CHICAGO.

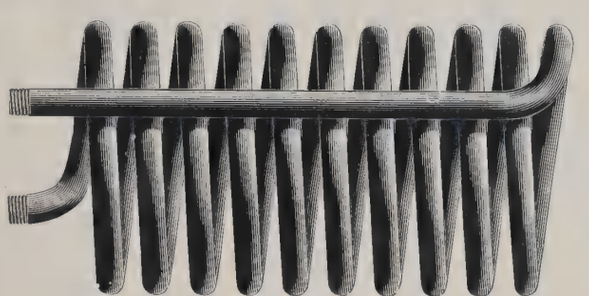
MANUFACTURERS OF

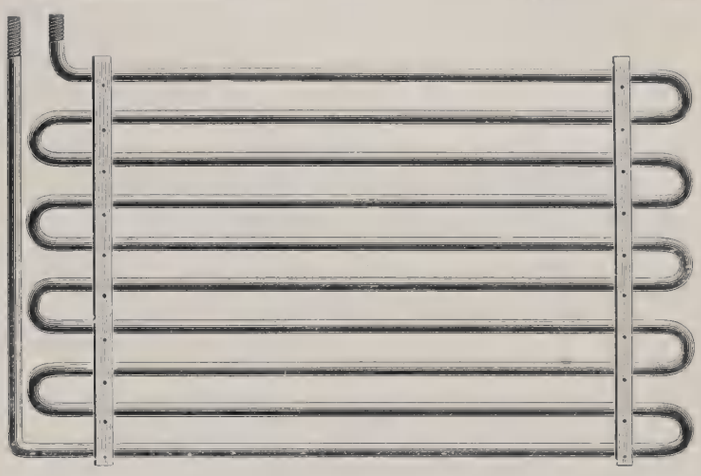
WROUGHT IRON COILS

FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES

These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.





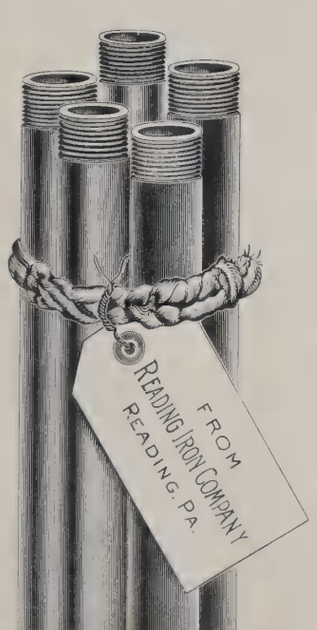
READING IRON COMPANY

.....MANUFACTURERS OF.....

WROUGHT IRON PIPE, CHARCOAL IRON BOILER TUBES, AND OIL WELL TUBING AND CASING . . . . . .

SPECIAL **Coiling and Ammonia Pipe**

FOR **Ice AND Refrigerating Machines**



Our Standard and Extra Heavy Pipe for bending and coiling purposes is being used largely by builders of Ice and Refrigerating Machines with unvarying success. We are also equipped for making Coils and Bends, Ammonia Valves and Fittings, Boilers, Tanks, Stills and Absorbers.

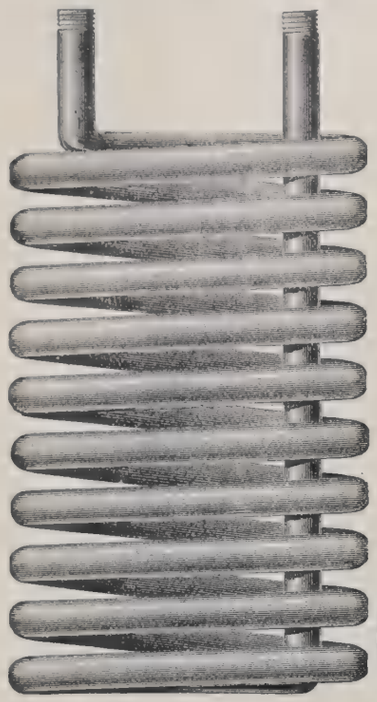
Having had a large experience as builders of various types of Refrigerating Machinery, we are prepared to successfully construct this class of work.

WE ALSO MAKE

IRON AND STEEL FORGINGS OF ALL DESCRIPTIONS.

W. T. HILDRUP, Jr., M. E., Sec'y & Treas. J. HERVEY PATTON, Chairman. D. E. TRACY, M. E., Sup't.

THE HARRISBURG PIPE BENDING CO. LIMITED.



OFFICE, N. E. COR. HERR ST. AND PENNSYLVANIA R. R.

HARRISBURG, PA.
P. O. BOX 603.

MANUFACTURERS OF

COILS AND BENDS

Of Wrought Iron Pipe

IN ROUND, OVAL, ZIG-ZAG, SPIRAL, HELICAL, AND TAPERING FORMS,

For Ice Making and Refrigerating

COILS OF ANY REQUIRED LENGTH, AND OF LARGE SIZES OF PIPE.

Prompt Delivery Assured

IRREGULAR PIPE BENDING A SPECIALTY.



AMMONIA BOTTLE.

AMMONIA BOTTLES OR FLASKS WITH WELDED HEADS

STRAIGHT OR CONCAVE

WROUGHT IRON ANHYDROUS AMMONIA BOTTLE COCKS ANY DESIRED PATTERN.

TANK DEPARTMENT

Stills and Absorbers

FOR ABSORPTION AMMONIA ICE MACHINES . . . .

BRINE AND CONDENSER TANKS

ALL SIZES

Sectional Tanks

A SPECIALTY.

These Tanks are made in flat sections, can be erected by unskilled labor, and are perfectly tight.

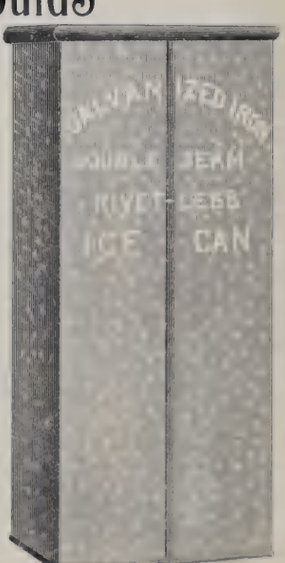
SPECIAL ATTENTION GIVEN TO REPAIRS AND REMODELING OF EXISTING ICE MACHINES.

ICE CAN DEPARTMENT

Galvanized Iron Ice Cans or Moulds

OF ANY SIZE, WEIGHT OR PATTERN.

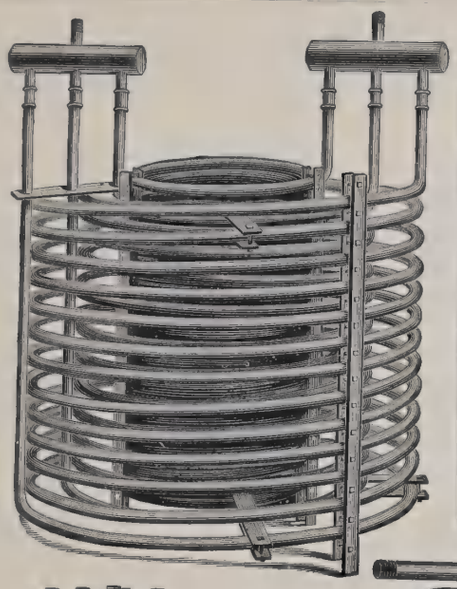
Our Double Seam, Rivetless Can has no rivets to catch the ice, which is freed from the can with less waste than any other style of Can in the market. . . . .



FLUSH BOTTOMS,
NO AIR POCKET TO FLOAT
CANS IN THE BRINE TANK.

EVERY CAN TESTED AND WARRANTED TIGHT.

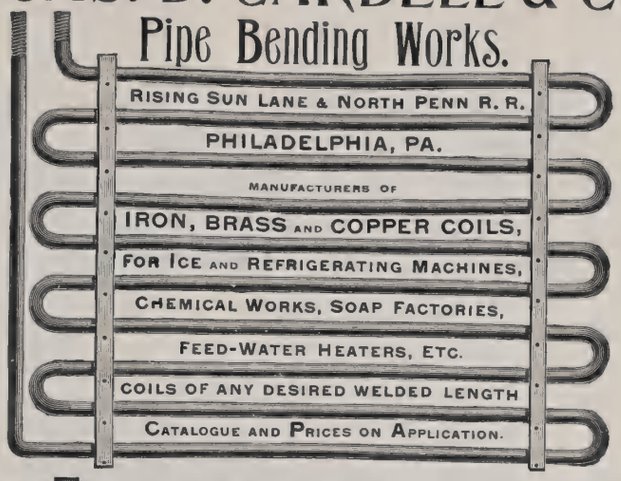
THE HARRISBURG PIPE BENDING CO. LIMITED.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

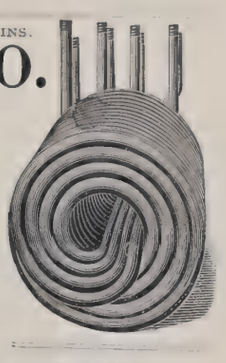
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

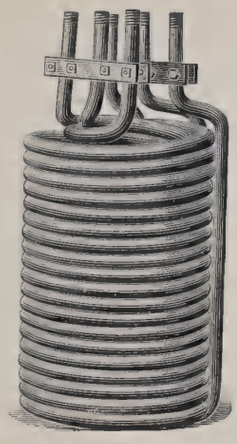
CATALOGUE AND PRICES ON APPLICATION.



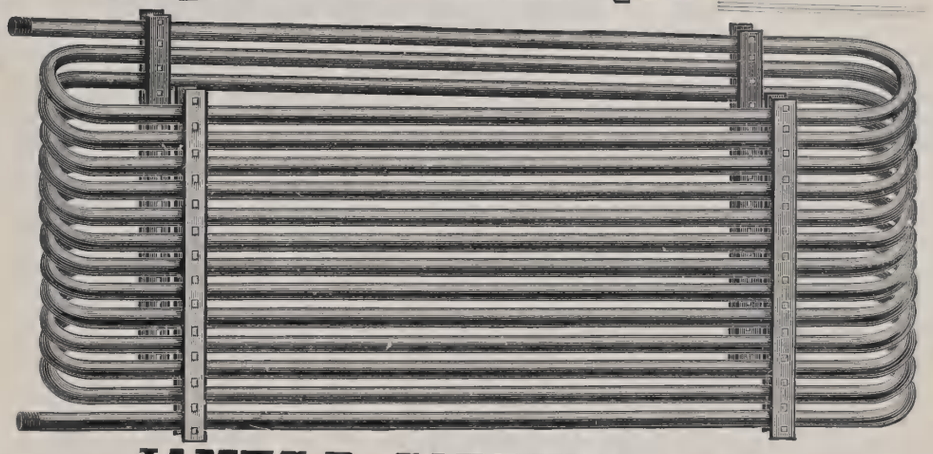
BENDING

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.

THE ELECTRIC PIPE BENDING COMPANY

OF

HARRISON, N. J.

ARE NOW PREPARED TO FILL ORDERS FOR

SPIRAL COILS,

ZIG-ZAGS, OVALS,

IRREGULAR SHAPES

OF ANY SIZE AND LENGTH

The work is done by the THOMSON ELECTRIC WELDING AND HEATING PROCESSES, thus giving greatly superior results to any of the old methods.

No injury from over-heating. Welds and Bends as sound as the rest of the pipe. All work promptly executed and guaranteed.

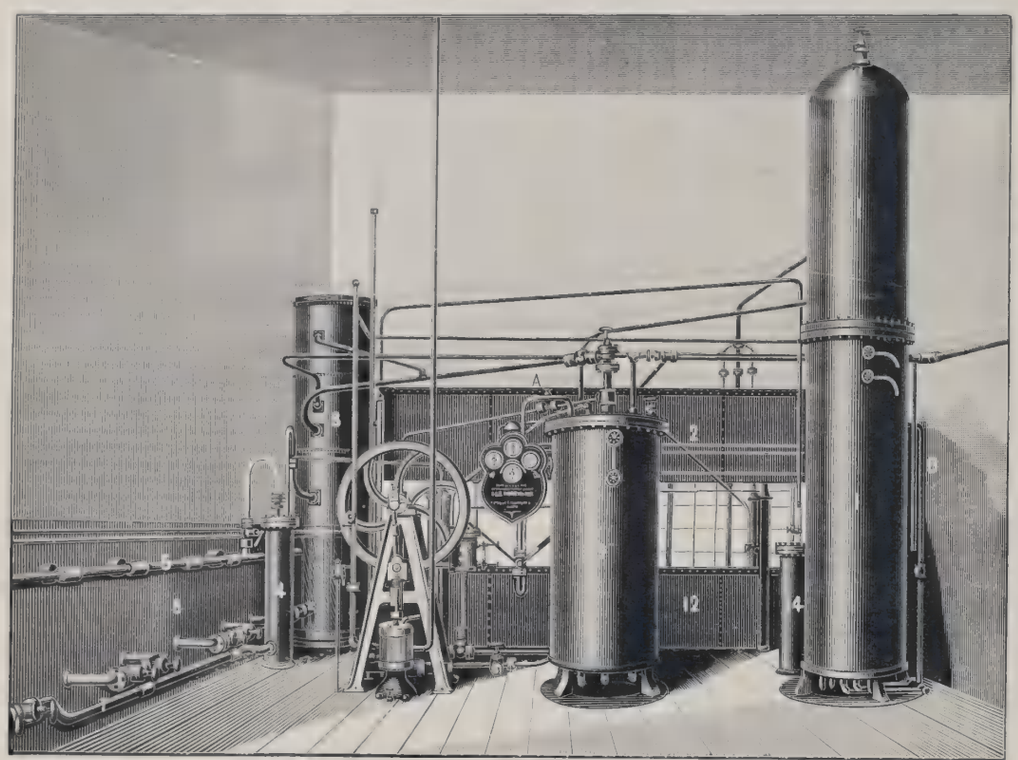
NO BURNT OR DEFECTIVE WELDS.

NO SCALE.

ADDRESS ELECTRIC PIPE BENDING COMPANY,

HARRISON, N. J.

COLUMBUS IRON WORKS IMPROVED Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

FARRELL & REMPE,

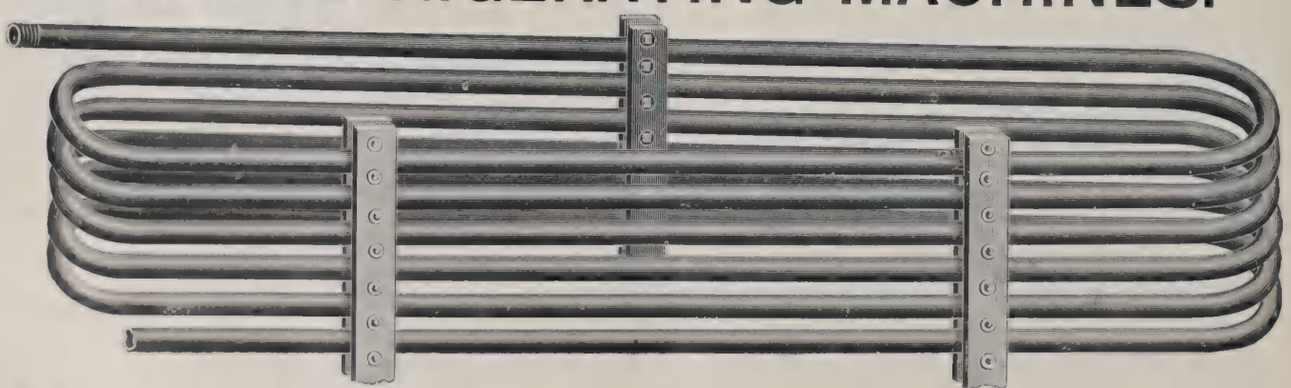
799, 801, 803 & 805 Ogden Avenue, corner Campbell Avenue, Chicago, Ill.

MANUFACTURERS OF

WROUGHT IRON COILS

—FOR—

ICE AND REFRIGERATING MACHINES.



All Ammonia Coils made of the very finest quality of Pipe (in any desired continuous length) and Tested to 400 lbs. Air Pressure.

Coils of all Descriptions for Heaters, Soap Makers, Blast Furnaces, Etc.

PIPE BENDING OF ALL KINDS A SPECIALTY.

PRICES FURNISHED ON APPLICATION.

General Eastern Agents, DIENST & LINCK, 32 & 34 Ferry Street, NEW YORK.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS,

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

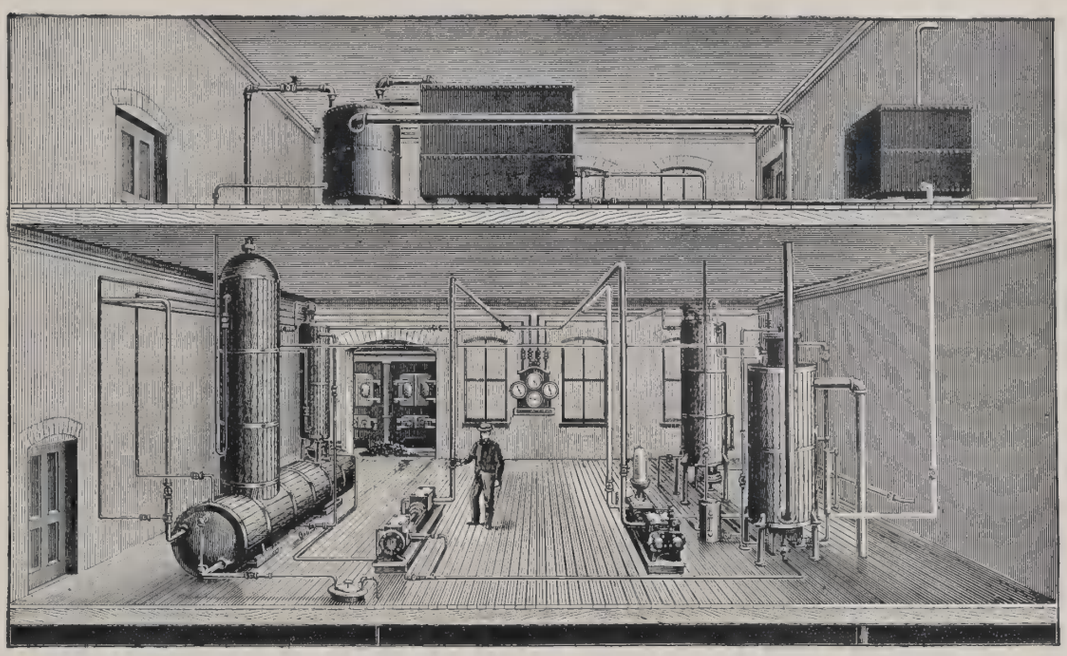
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



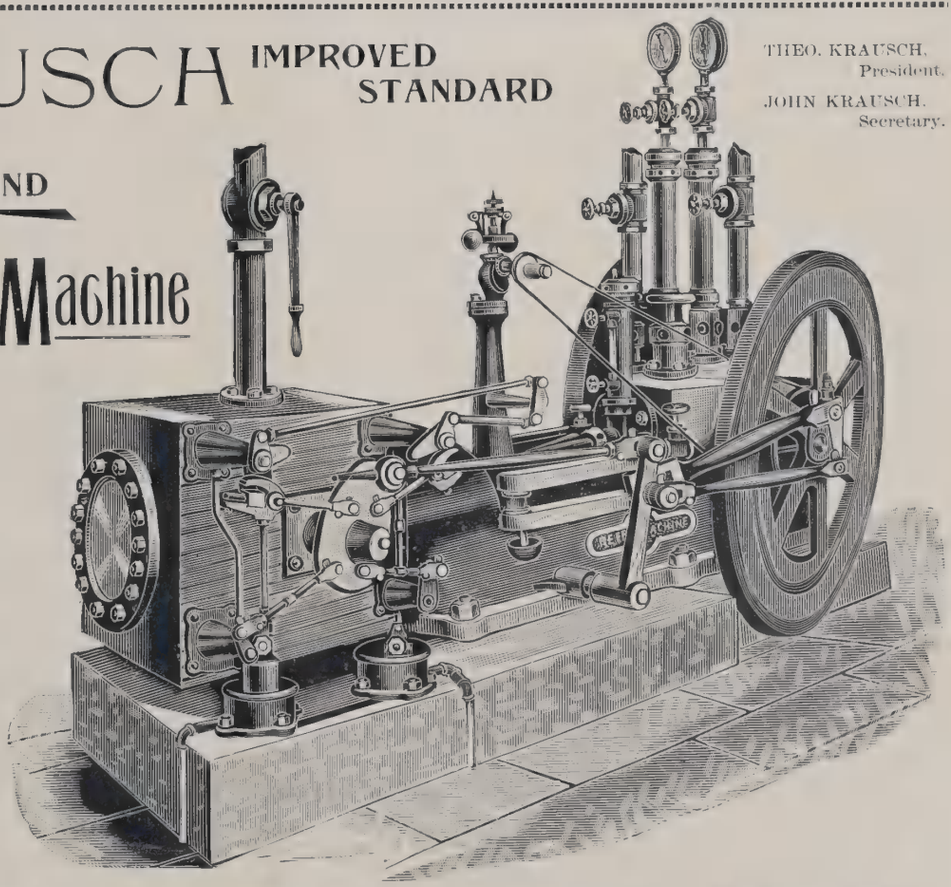
ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK. 46 BRIDGE STREET, NEWARK, N. J.

THE KRAUSCH IMPROVED STANDARD ICE AND Refrigeration Machine

THEO. KRAUSCH, President.
JOHN KRAUSCH, Secretary.



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops, Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK.

OR

THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

For all purposes. Containing latest improvements, making REGULAR that which before was NOT regular. Our 15-ton Absorber contains over 6,000 square feet of absorbing surfaces, enabling the temperature of absorption to vary from 50 to 110 deg. Fahr. without affecting operations. One foundation for all machinery. Ice Plant all on one floor. Small water consumption. Economical in operation. Positive and continuous in results. **We guarantee Production and Transparent Ice.** We refer to Seymour Ice Co. (Ind.) having machine with latest improvements.

USING EITHER LIVE OR EXHAUST STEAM, WITH NON-EXPLOSIVE RETORT. AUTOMATIC.

Make your exhaust steam produce silver dollars by using it through our New Designed Machine with improvements for Refrigerating, Cold Storage or Ice Making, from 50 lbs. to 3 tons.

CIRCULARS AND ESTIMATES ON APPLICATION.

THE CASE

REFRIGERATING MACHINE CO.

BUILDERS OF

Ice and Refrigerating Machines

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

FOR ICE MAKING AND ARTIFICIAL REFRIGERATING

BUFFALO, N. Y.

JOHNSON,

McCARTHY

& JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

—AND—

ICE AND REFRIGERATING MACHINES . . . . .

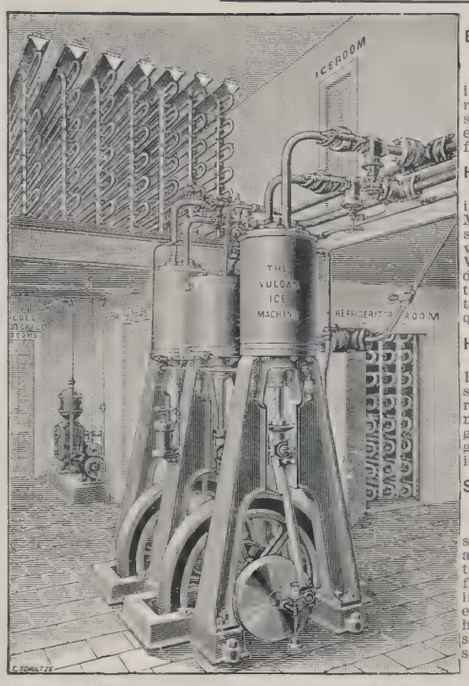
Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and . . . . .

Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect"

Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

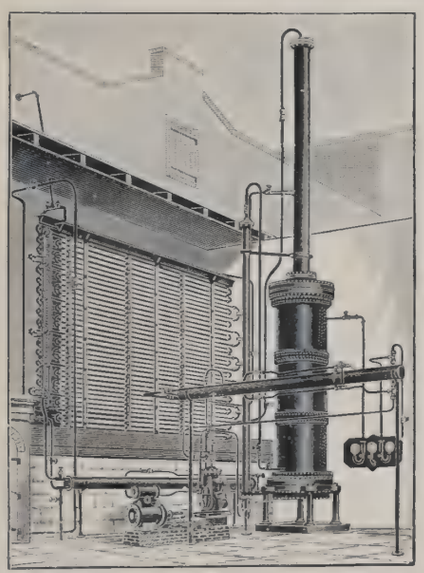
135-145 Fremont Street, SAN FRANCISCO, CAL.

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF....

Ice and Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. PRADLEY, Cold Storage, Philadelphia, Pa.
TRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

Plans and estimates for plants erected ready for operation cheerfully given on application.

Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

NEW YORK OFFICES, 9 AND 11 WALL STREET.

THE CRAFT REFRIGERATING MACHINE CO.

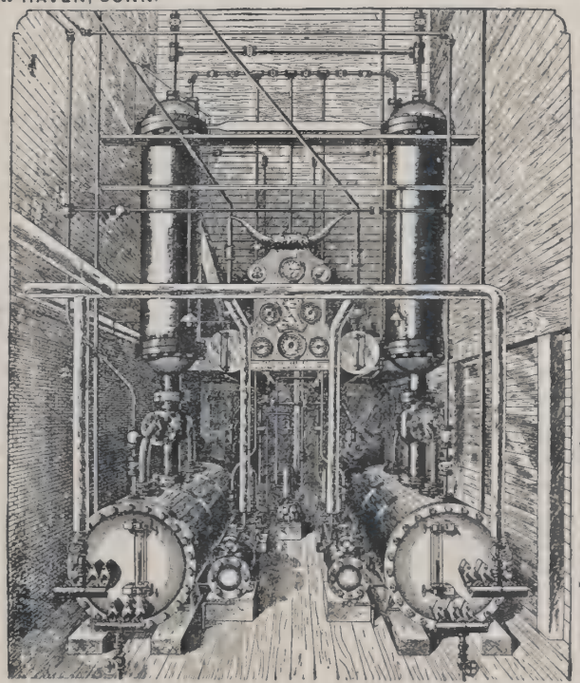
JAMES B. CRAFT, Prest.
F. L. BIGELOW, Vice-Prest.
GEORGE S. BARNUM, Sec. & Treas.

No. 15 Cortlandt Street, NEW YORK,

WORKS: NEW HAVEN, CONN.

....MANUFACTURERS OF....

Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.



Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

ICE AND REFRIGERATING MACHINES

FOR ICE MAKING PLANTS.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

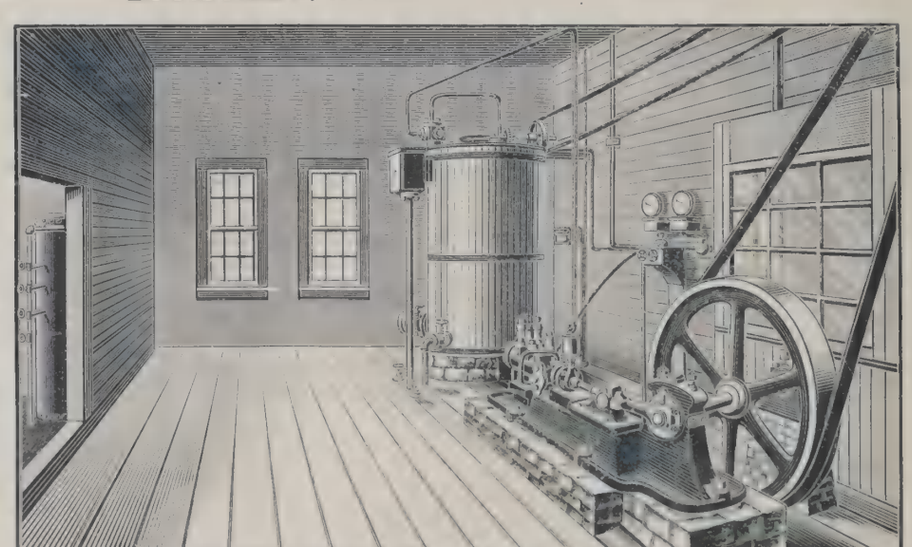
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained



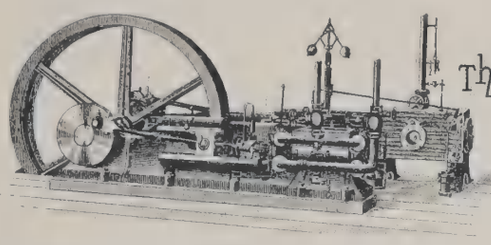
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.
Manufacturers of
CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.
ICE-MAKING PLANTS
FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.
Direct Expansion or Brine System
MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.
E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF
THE KEELING ..AUTOMATIC.. ICE MACHINE
FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.
WRITE FOR ESTIMATES AND FURTHER INFORMATION.
VAN WINKLE GIN AND MACHINERY CO.
OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The American Ice Machine Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC
REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS
From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

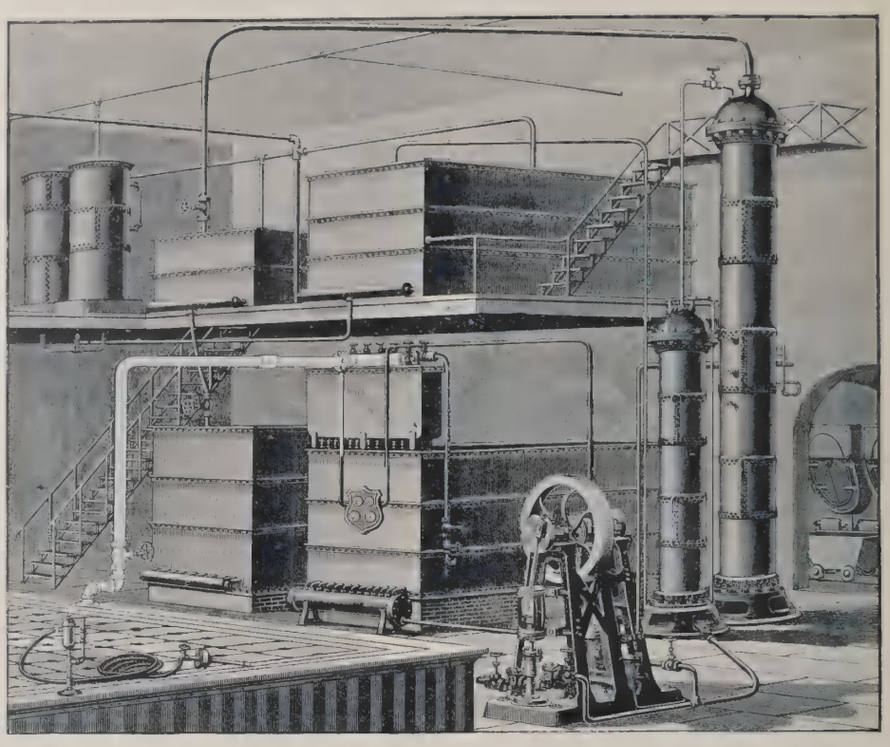
5. **We can make more ice or cold air than** any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

Blymyer Ice Machine Company

CINCINNATI OHIO . . . . .



THE ***ABSORPTION MACHINE*** made by the Blymyer Ice Machine Co. is superior to any compression machine, either for refrigerating or ice making. These machines are ***radically different*** from all other absorption machines, and are in every way superior to them.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co.(2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co.	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston	West Point, Miss.
1	3 "	DeCoppet Ice Co	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington,W.Va.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y,Cld.Stor.&Ice.Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co.(2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
*1	15 Ton.	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co.(4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg.&Cd.Sto.Co.(2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co	Ashland, Ky.
**1	8 "	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs,Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

* These machines were erected in 1890.

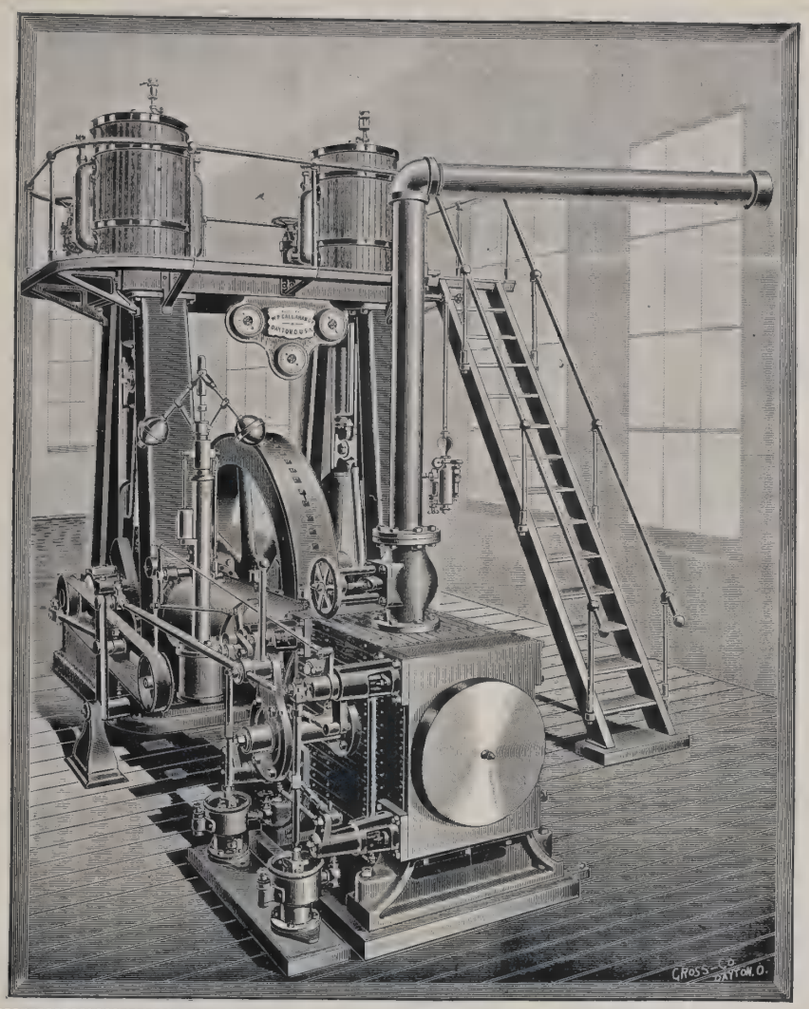
** These machines were erected in season 1891.



BLYMYER REFRIGERATING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	Address.
	Ton		
2	50	Louisiana Brewing Co.	New Orleans.
1	40	Toledo Br'g & Malt'g Co.	Toledo.
1	40	Hudepohl & Kotte (Brew'y	Cincinnati.
1	50	Savannah Brewing Co.	Savannah.
1	25	Schantz & Schwind (Br'y)	Dayton
1	15	John Smith's Sons (Brew'y	Youngstown.
1	12	Christ Diehl (Brewery)	Defiance.
1	12	Genessee Oil Works	Buffalo.
1	12	S. Davis, Jr., & Co. (Pack'rs	Cincinnati.
1	50	Occidental Packing & Provision Co.	Lincoln.
1	15	Thos. McFadden, Jr. (Cd. St.	Pittsburgh.
1	15	Grocers' Supply Co. (Cd. St.	Pittsburgh.
*1	40	Adolph Coors (Golden Br'y	Golden.
*1	20	F. Conrad (Brewery)	Anaheim.
*1	25	The Sachs-Prudens Ale Co.	Dayton.

* These machines were erected in 1890.



CUT OF . . . . . .
FIFTY TON REFRIGERATING
AND . . . . . .
THIRTY TON ICE MAKING
MACHINE, BUILT BY

W. P. CALLAHAN & CO.

BUILDERS OF

Ice Making AND Refrigerating Machinery

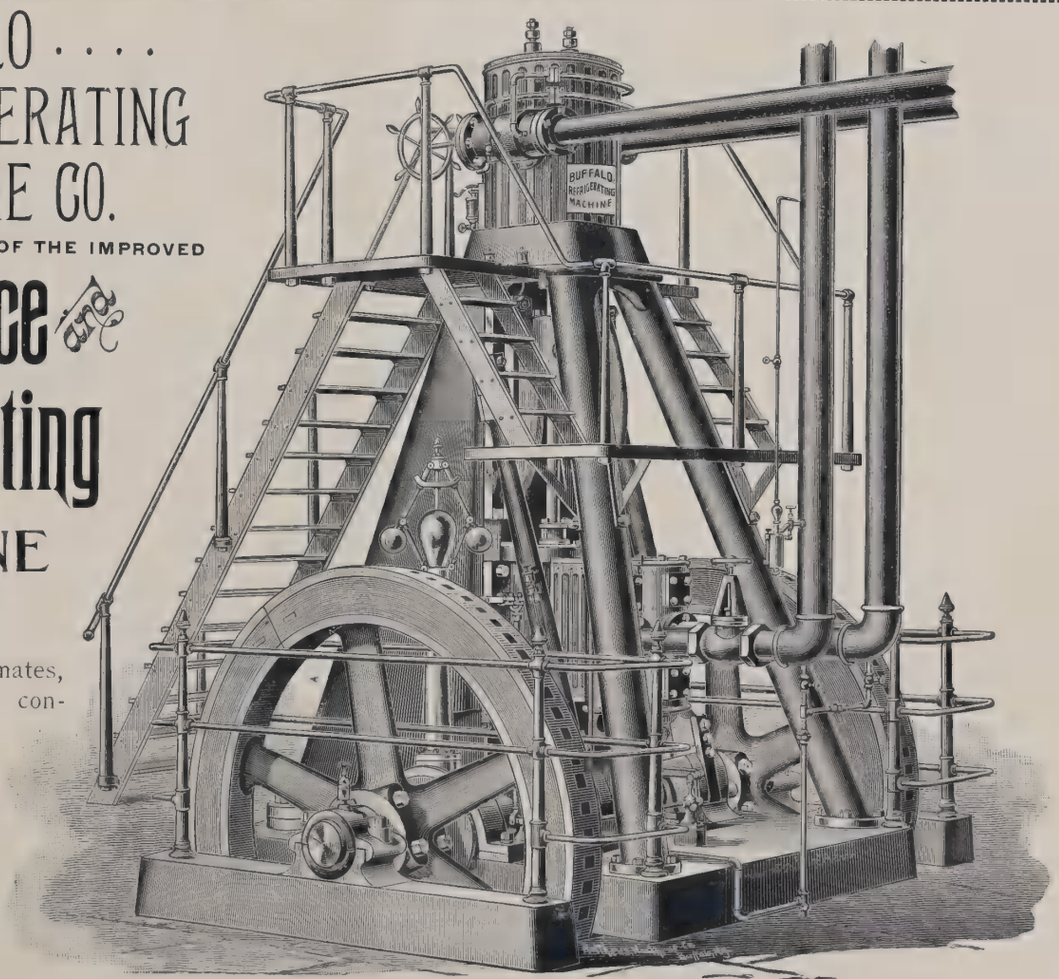
UNDER M. DENNEDY'S PATENT.

DAYTON, OHIO, U. S. A.

BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE



Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

ICE MAKING MACHINERY

SIMPKIN, HILLYER & CO.

MANUFACTURERS OF THE

WARWICK

Ice Machine and Refrigerating Apparatus

THE SIMPLEST AND MOST EFFECTIVE ICE MAKING MACHINERY ON THE MARKET.

ALL working parts made to gauge and template, so as to be readily duplicated. Correspondence solicited. Testimonials from parties using our machines on application. We build our own machinery, and therefore can guarantee everything fully. Our machine will in every case make the amount of ice guaranteed.

VESSEL AND STEAMSHIP PLANTS.

GENERAL OFFICE, RICHMOND, VA.

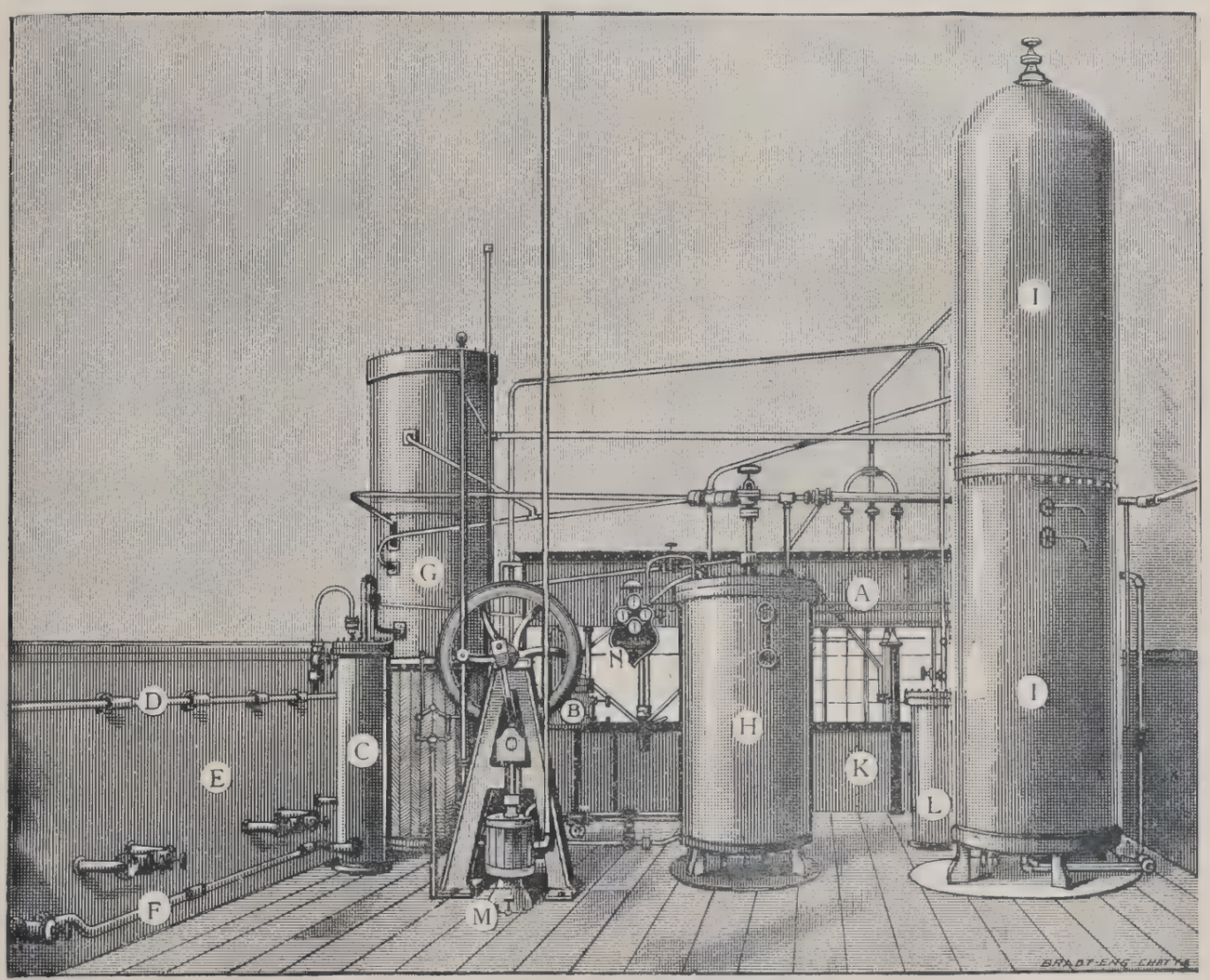
WORKS: NEWPORT NEWS, VA.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

• • • The Latest Improved Absorption • • •

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

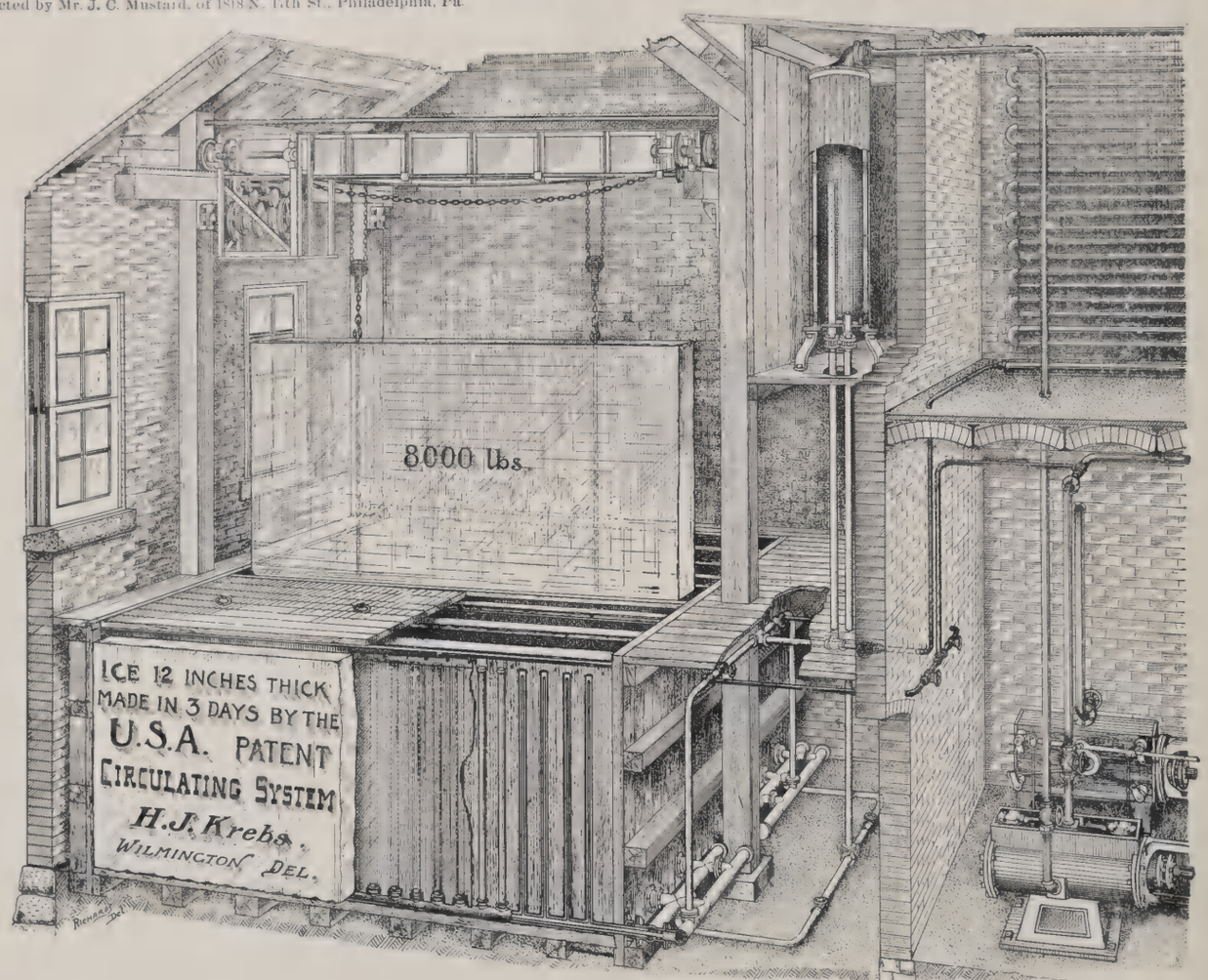
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.: Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WLMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Auttle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory, Norfolk, Va. Suffolk Ice Co., Suffolk, Va

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

CORRESPONDENCE SOLICITED.

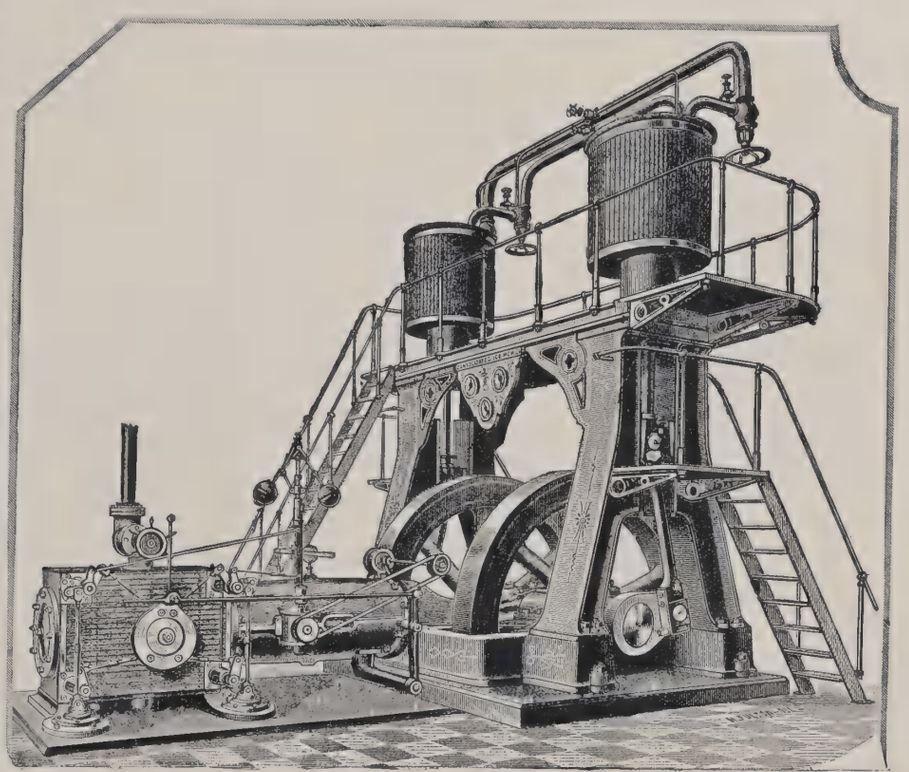


CONSOLIDATED ICE MACHINES

FOR several years past we have been engaged in building Consolidated Ice Machines, and many of the very best running in the United States, at the present time, are of our manufacture. Since the original Company have failed, we have concluded to continue this business, and hereafter will manufacture, to order, any kind or style of a Consolidated Ice Machine desired. We will also contract for complete plants, and will put in either direct or brine circulation, as may be desired. We make a specialty of furnishing duplicate parts, and keep them always in stock, and can furnish on short orders any detail of these machines. We manufacture special steel valves and white metal rings designed especially for ammonia work.

We guarantee protection against any and all claims or pretended claims for patents on these machines.

These machines are known throughout the United States for the excellence of their construction, and their superiority to all others in use. They need no better recommendation than their own work. All the material and workmanship on them is of the finest quality.



We have the original drawings and patterns in our possession, and can furnish a better machine for less money than can be built elsewhere. We also manufacture and keep on hand to supply the trade the finest steel fittings and steel valves made in the world, designed especially for ammonia work, and will be pleased to quote prices to purchasers.

NOTE.—It has come to our knowledge that parties owning or claiming to own a bogus patent, issued to one James Boyle in 1876, for an ammonia compressor, have been putting in circulation notices that the pumps used on the Consolidated Refrigerating Machines is an infringement on said patent, and that they will bring suit against any one using them; therefore we hereby guarantee to all persons purchasing one of our machines protection against said fraudulent claims, and request all persons receiving one of such notices to forward the same to us, with a statement setting forth whether they have been influenced not to buy a Consolidated Machine thereby. We also give the parties setting up these claims public notice that we will bring suit against them for damage to our business by them, by misrepresentation and fraud.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF **ICE**

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE & PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

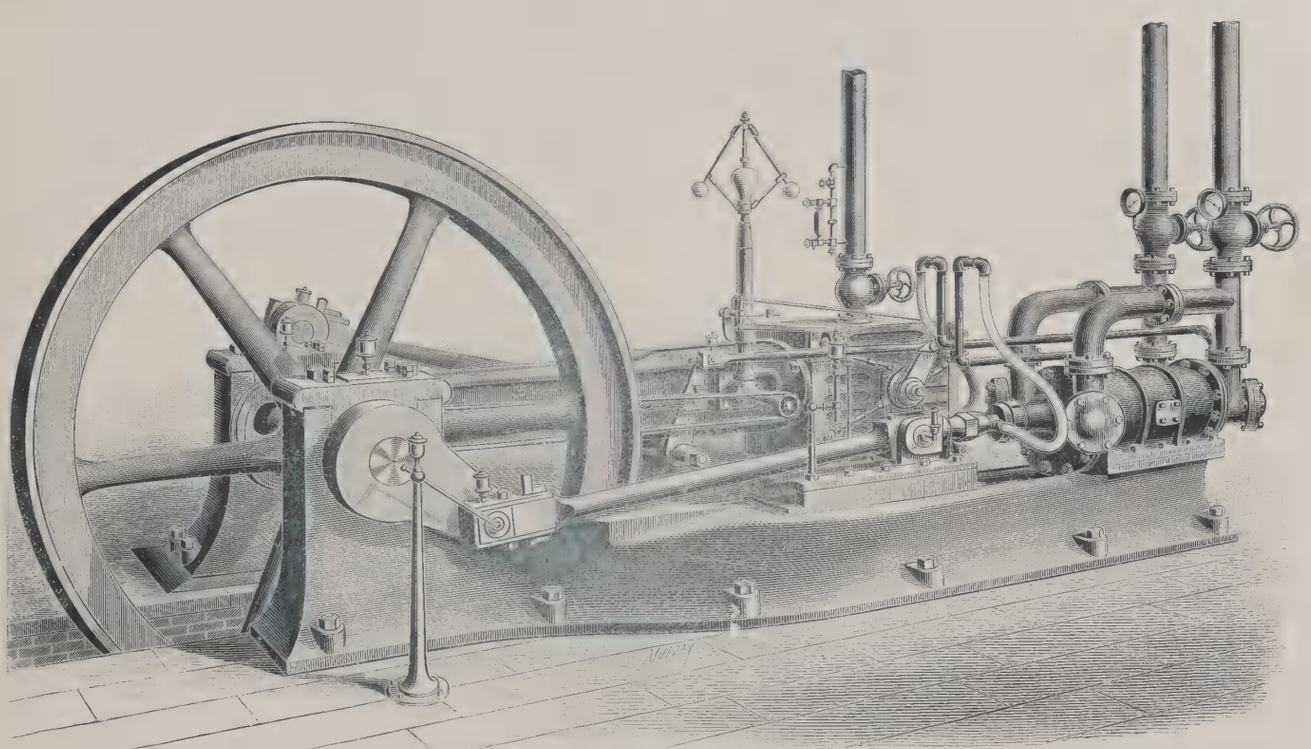
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Borcel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

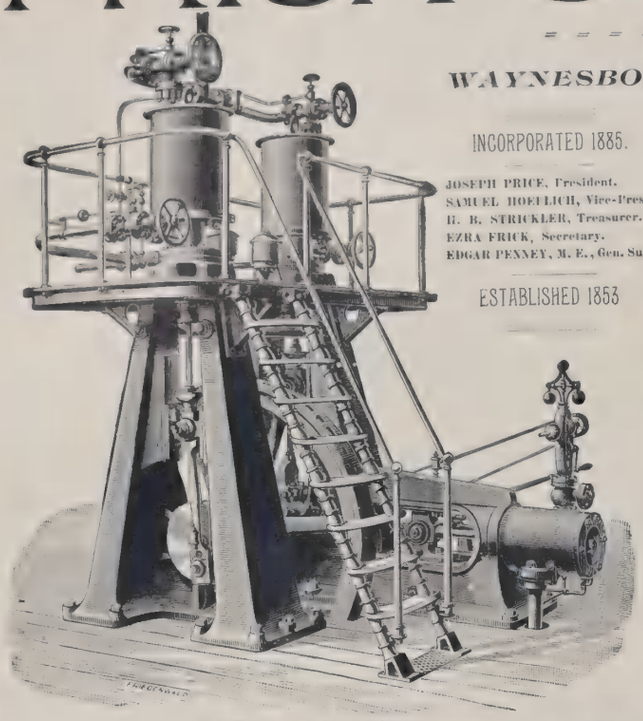
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.

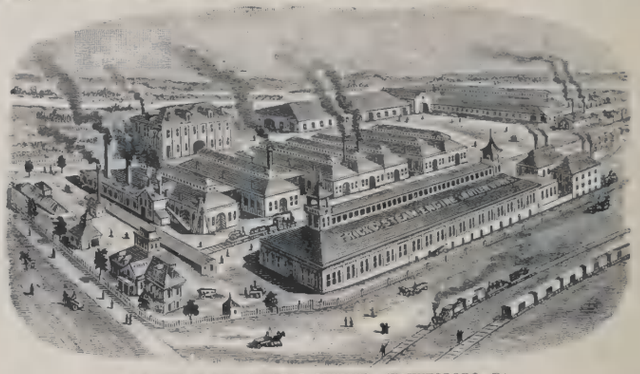


5-Ton Machine.

INCORPORATED 1886.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

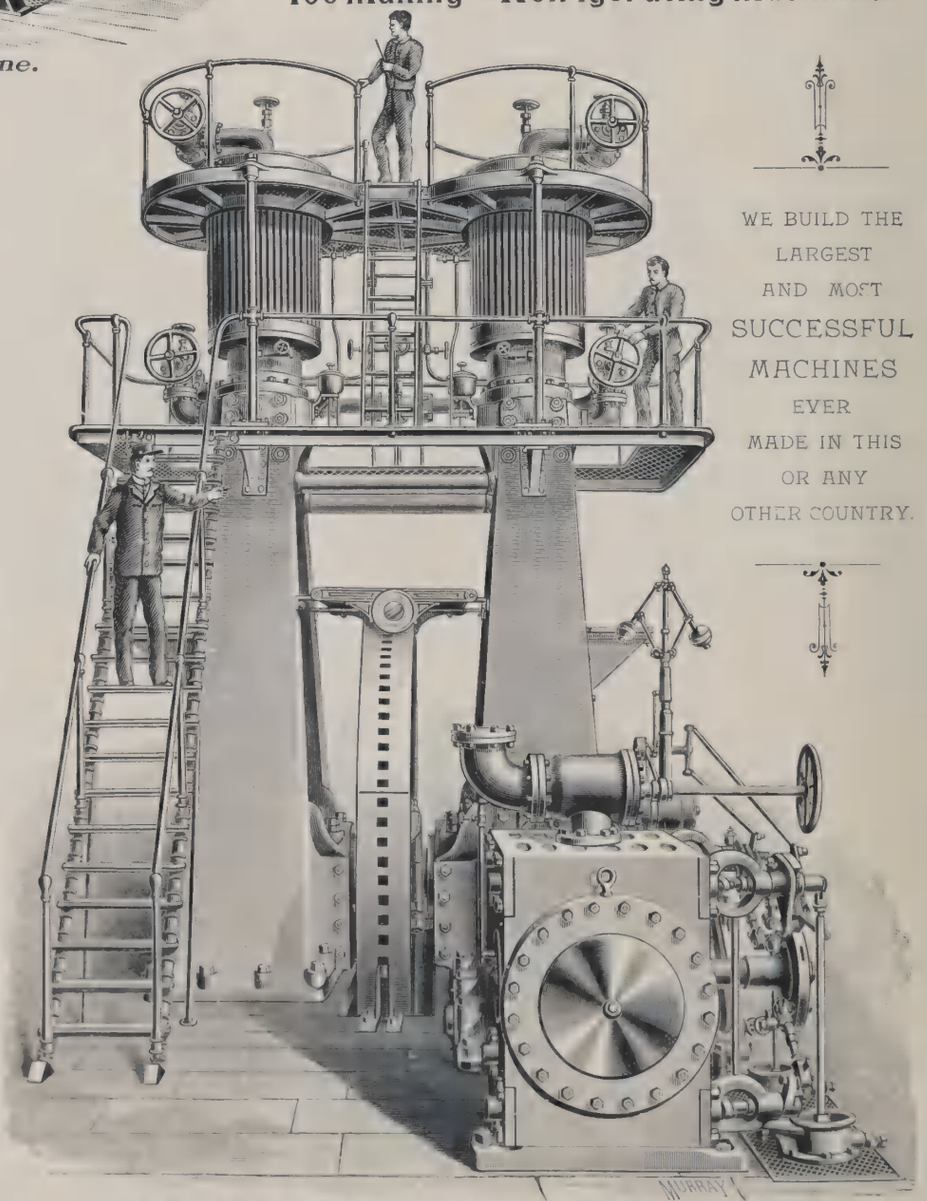
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Lurton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh	10
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

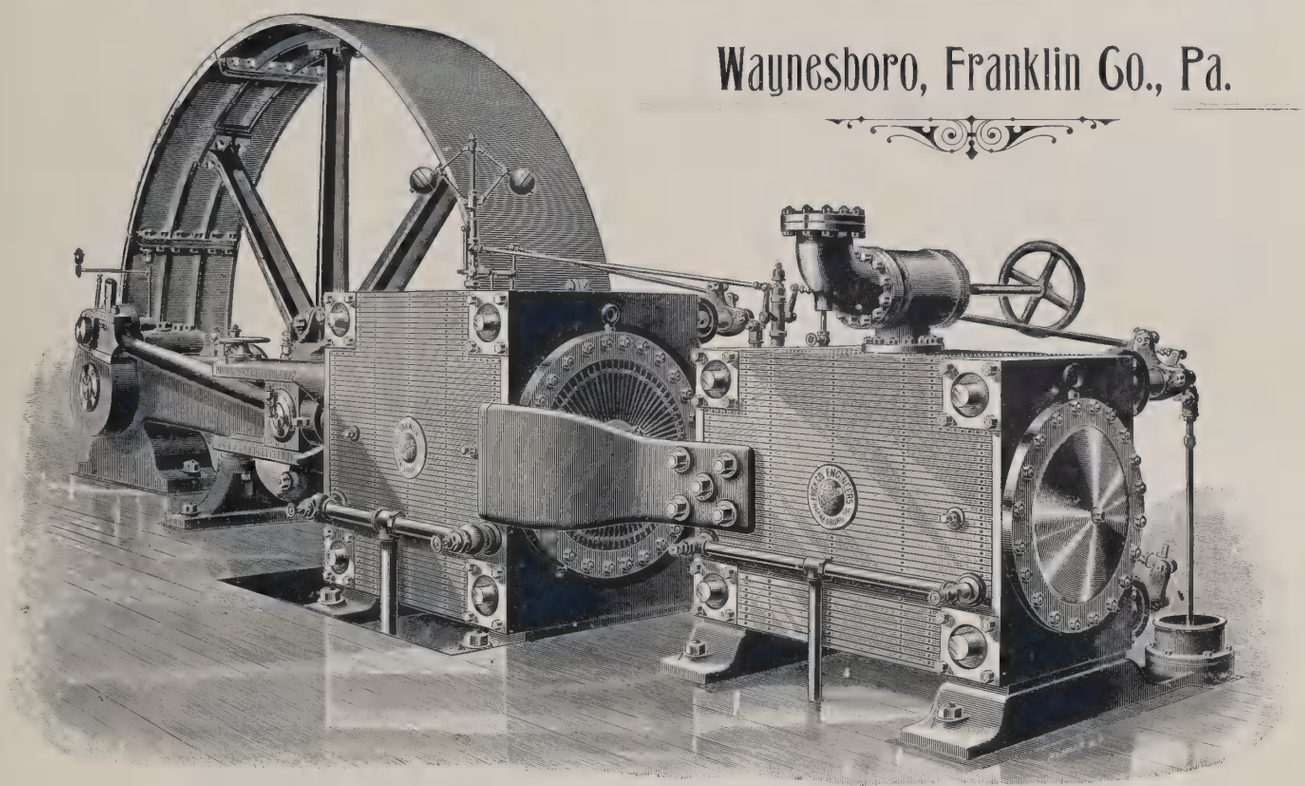


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

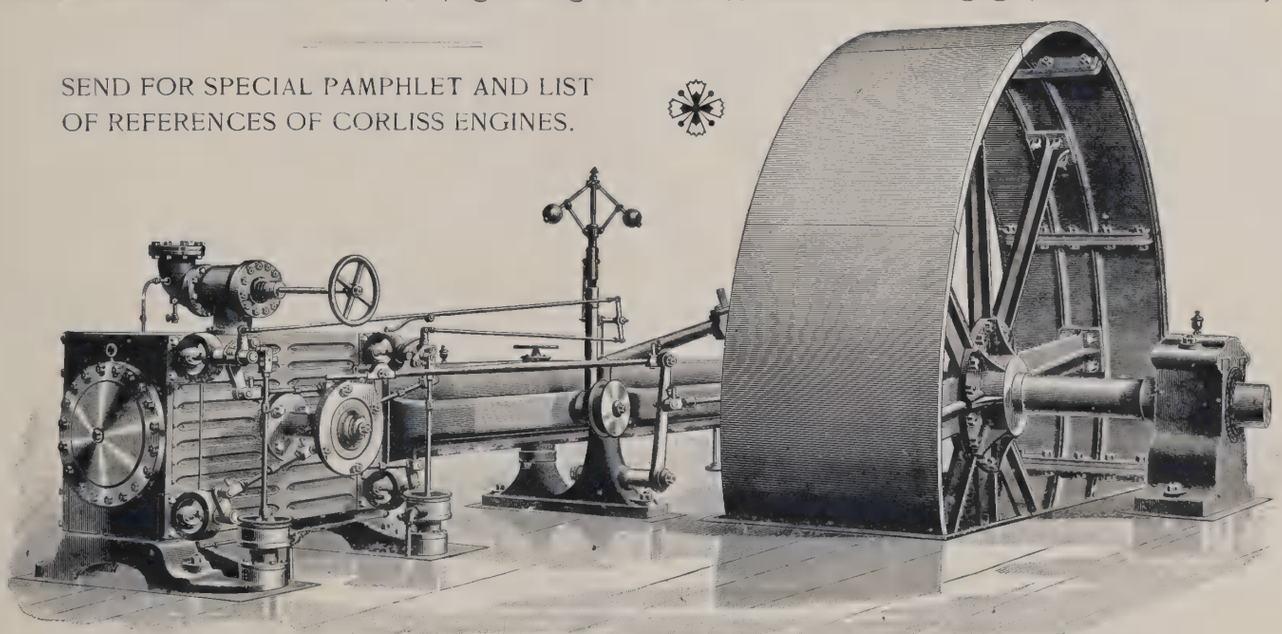
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000-horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

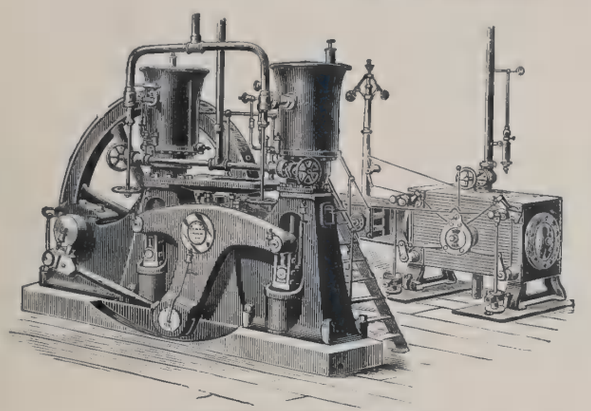
Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION.....

PITTSBURGH, PA.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

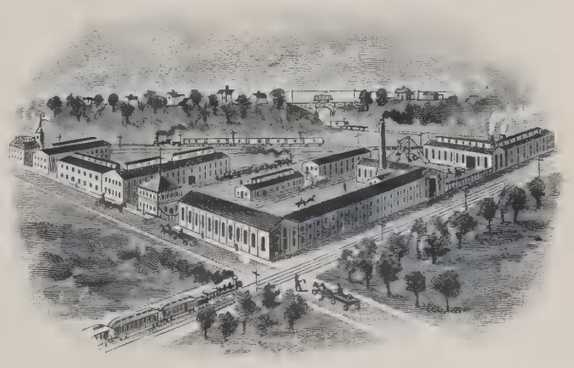
(REFRIGERANT: ANHYDROUS AMMONIA.)



THE HERCULES ICE MACHINE.

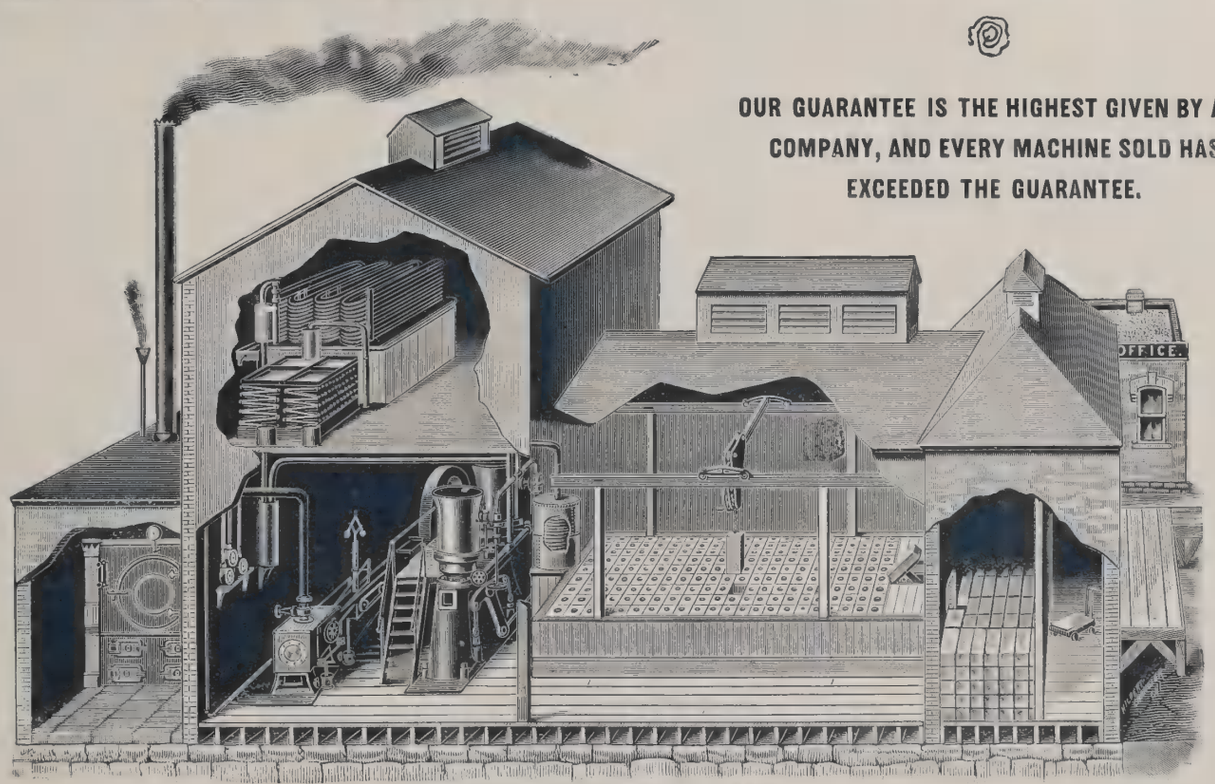
The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.



THE HERCULES MODEL ICE PLANT.

SALISBURY ICE MANUF'G CO.

SALISBURY, MD.

HERCULES IRON WORKS: October 2, 1891.

Our plant which you erected for us last year can, we think, show as good record, if not better, than any machine of another make. Our plant was put in for 12½ tons, but this season our orders were so pressing that from the 23d of June to the 2d of September we drew an average of 14¼ tons daily, while our consumption of coal during that period was but 2½ tons daily of 24 hours. The ice, too, was firm and solid.

Yours truly, J. S. ADAMS, Sec'y.

ARTESIAN ICE COMPANY,

FORT WORTH, TEXAS.

HERCULES IRON WORKS: October 21, 1891.

DEAR SIRS: After three years of continuous service, the 20-ton ice machine you built for us seems in every particular just as good as new. There seems no perceptible wear of the machine as yet: the repairs amount to no more than could be expected on any first-class steam engine. The machine has fully come up to your guarantee, and even more. We have made as high as 24 tons per day of the finest ice that has ever been turned out in this city. We also find it very economical in the use of ammonia; in fact, it has fulfilled our expectations in every way.

W. B. WHEELER, Gen'l Manager. ARTESIAN ICE CO.

THE HERCULES BLUE BOOK No. 1, ON ICE MAKING AND REFRIGERATION, IS JUST ISSUED AND WILL BE SENT FREE TO INTENDING PURCHASERS.

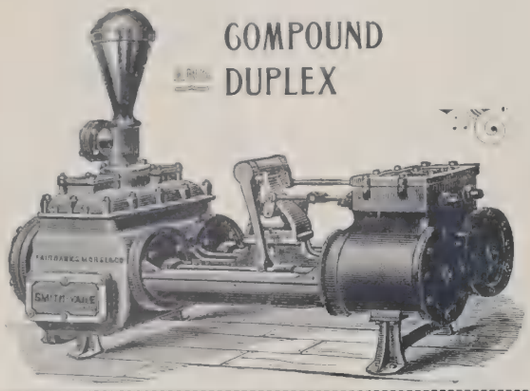
THE HERCULES IRON WORKS,

NEW YORK OFFICE, 150 BROADWAY.

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.

WORKS, AURORA, ILL.

THE SMITH & VAILE CO. DAYTON, OHIO.



COMPOUND
DUPLEX

STEAM PUMPS

FOR EVERY PURPOSE.

WE MAKE A SPECIALTY OF

BRINE PUMPS,
COLD WATER PUMPS,
BOILER FEED PUMPS.

FOR

Ice & Refrigerating Machines.

Get our Special Prices before buying elsewhere.

NEW YORK HOUSE, 112 LIBERTY ST.

THE GORDON STEAM PUMP CO.

. BUILDERS OF .

Steam Pumping Machinery

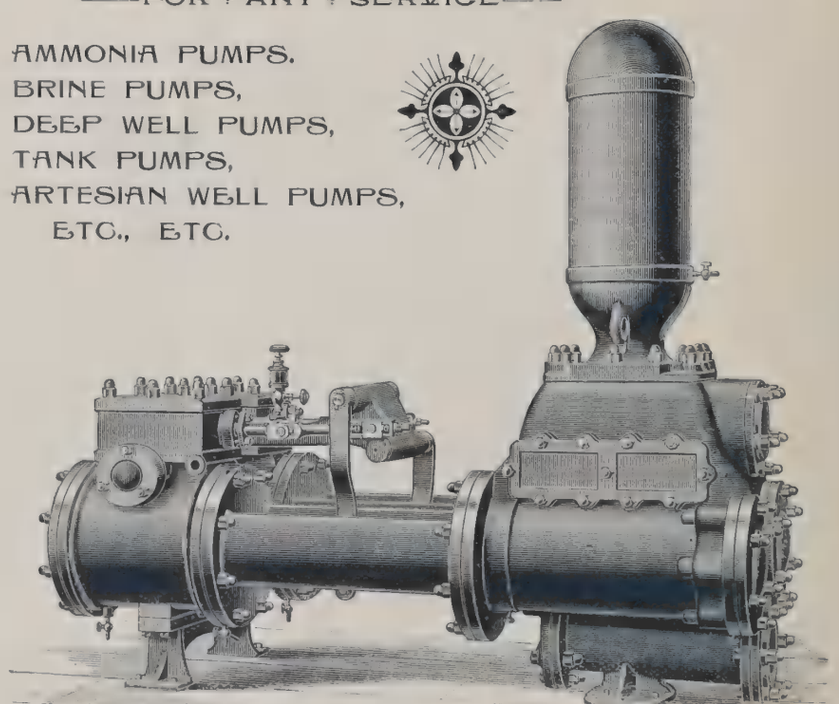
FOR ANY SERVICE

Pumps

ESPECIALLY ADAPTED FOR USE IN CONNECTION WITH

Refrigerating Machinery

AMMONIA PUMPS.
BRINE PUMPS,
DEEP WELL PUMPS,
TANK PUMPS,
ARTESIAN WELL PUMPS,
ETC., ETC.



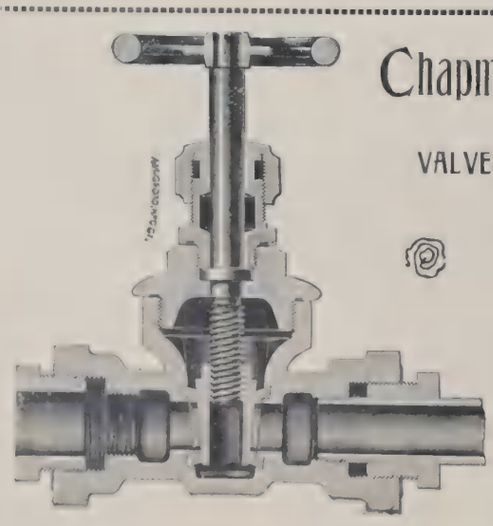
MAIN OFFICE AND WORKS

HAMILTON, OHIO.

BRANCH OFFICES

NEW YORK—136 Liberty St.
PHILADELPHIA—705 Arch St.
PITTSBURGH—410 Lewis Block.
CHICAGO—Phœnix Building.
ST. LOUIS—703 Market St.
CLEVELAND—146 Water St.

Correspondence Solicited.



Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

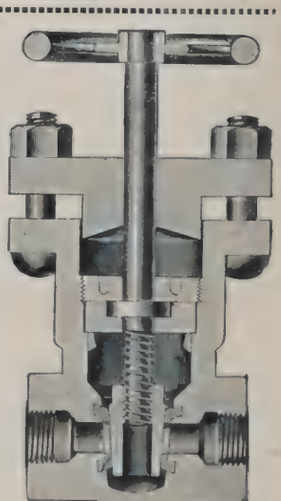
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works,
INDIAN ORCHARD, MASS

Treasurer's Office,
72 Kilby and 112 Milk Sts.
BOSTON, MASS.



Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

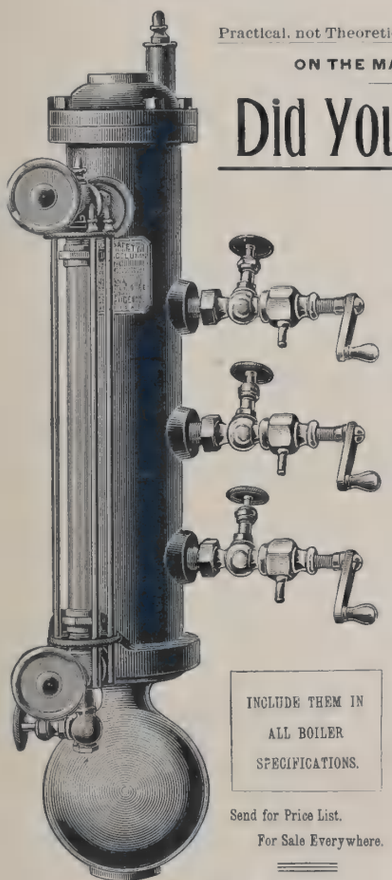
The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what it means to have the water carried uniformly at the proper level?

IT MEANS

safety, saving of fuel, steady power, and more of it, no leaky tubes, no burned boilers, no stoppage for expensive repairs.

ALL

of which

YOU CAN

secure for merely nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.

For Sale Everywhere.

The Reliance Safety Water Columns.

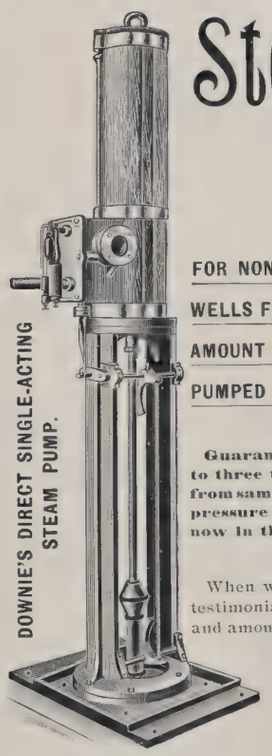
THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

DOWNIE'S

DIRECT, DOUBLE-ACTING

Steam Pump

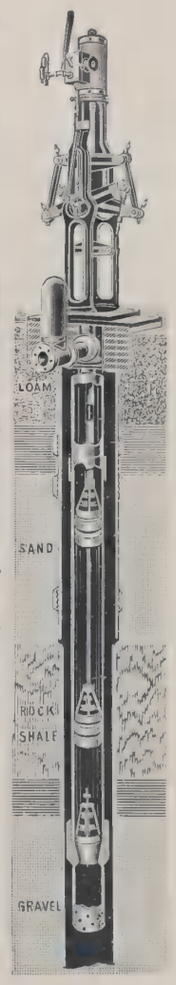


FOR NON-FLOWING ARTESIAN WELLS FROM WHICH A LARGE AMOUNT OF WATER IS TO BE PUMPED . . . . . .

Guaranteed to lift from two to three times as much water from same well and same steam pressure as any other Pump now in the market.

When writing for prices and testimonials, give depth of well and amount of water wanted.

Sole Patentees and Manufacturers.



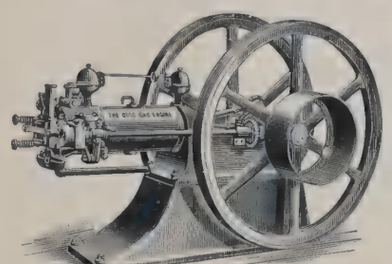
Downie Bros. & Nevin, Limited

NEW BRIGHTON, PA.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

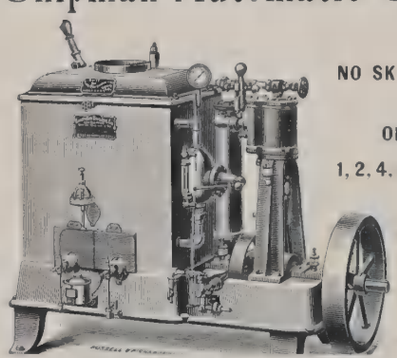
Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

THE

Shipman Automatic Steam Engine



NO SKILLED ENGINEER.

KEROSENE, PETROLEUM OR NATURAL GAS FUEL.

1, 2, 4, 6 and 8 HORSE POWER.

The most reliable, economical and satisfactory power for small

REFRIGERATING MACHINES, CREAMERIES, PACKING HOUSES, BOTTLERS, COLD STORAGE, Etc.

Send for Catalogue. . . . .

SHIPMAN ENGINE CO., 328 Summer Street, Boston, Mass.



THE CHEF.

McGray Refrigerator AND Gold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS
OF ALL KINDS OF

REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Gold Storage Buildings.

CHICAGO OFFICE,
Loomis Building, Clark and South Water Streets.

THE JACKSON REFRIGERATOR CO.

EXPERTS IN
ICE AND MECHANICAL REFRIGERATION.

Cold Storage Architects

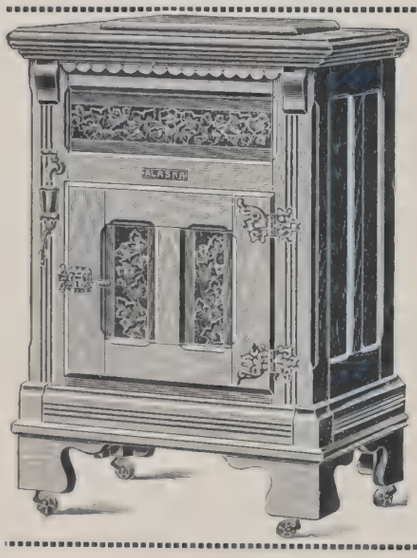
Over 300 Jackson Houses, Cooled by Ice, in Successful Operation.

PLANS AND SPECIFICATIONS FURNISHED FOR BUILDINGS AND MACHINERY.

They never become musty, and carry perishable goods longer and in better condition than any other house.

Send for "Refrigeration," a scientific treatise on Ice and Refrigeration, with Circular and Testimonials.

605 RIALTO BUILDING, CHICAGO.



THE ALASKA REFRIGERATOR CO.

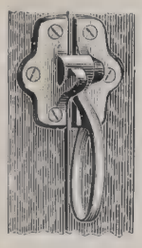
MUSKEGON, MICH.

WRITE FOR CATALOGUE AND PRICE LIST.
SPECIAL REFRIGERATORS MADE TO ORDER.

ART IN REFRIGERATORS.

WHY not, as long as we have the skill and the brains to put it there without extra cost to you? Merit should always come before Art in the manufacture of these goods. We, however, have reached the second stage, and now offer you the greatest variety and choicest designs, either plain or combined with side-boards, china closets, kitchen cabinets, etc. We make Refrigerators for every purpose, for Families, Restaurants, Grocers, Butchers, Hotels, Apartment Houses, etc., all bearing our Trade Mark, "THE GLACIER," and having SEVEN walls to preserve the ice, and all our other improvements. "Best in the World." Send for complete catalogue.

THE NORTHERN REFRIGERATOR CO., GRAND RAPIDS, MICH.



P. J. CONROY & CO.

75th St. and Island Road,
PHILADELPHIA.

CONROY MANUFACTURERS OF THE

Refrigerator Door Fasteners

PATENTED DECEMBER 5, 1885.

Which are rapidly supplanting all others. The only fastener that forces the door open as well as shut.

HILPERT & CHANDLER

ENGRAVERS

BY ALL PROCESSES.

REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.

167 DEARBORN ST. CHICAGO.

....THE....

HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

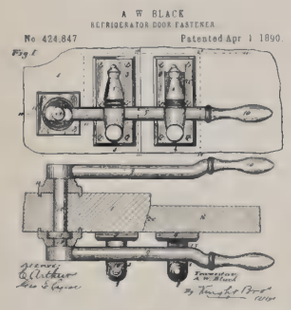
We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

48 EXCHANGE PLACE, - - - NEW YORK.

BLACK'S LATEST IMPROVED . . .



Refrigerator Door Fastener

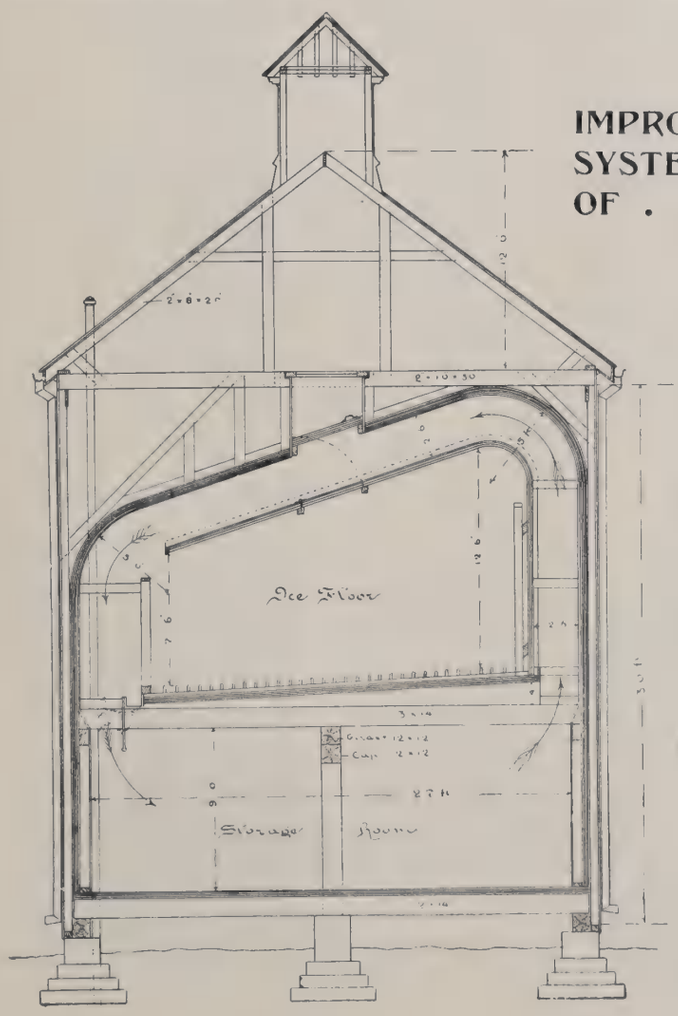
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
SENT BY EXPRESS ON RECEIPT OF $12.

A. W. BLACK, ST. LOUIS, MO.



BLACK'S

IMPROVED SYSTEM OF . . . .

Cold Storage

.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, ST. LOUIS, MO.

THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

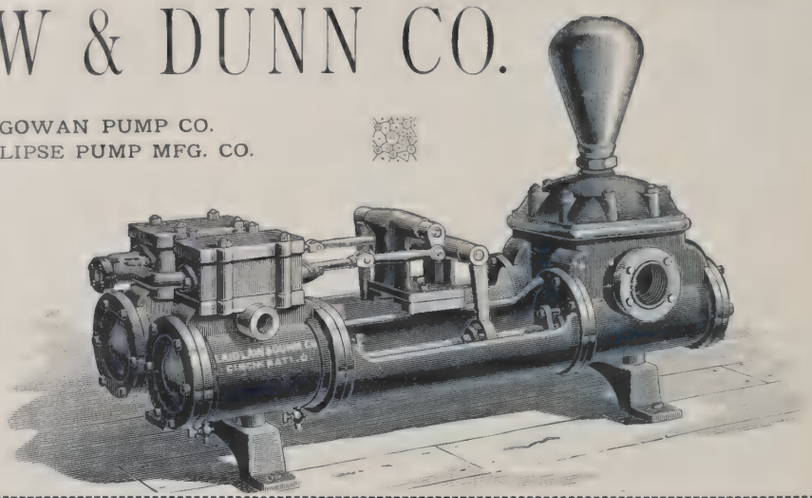
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

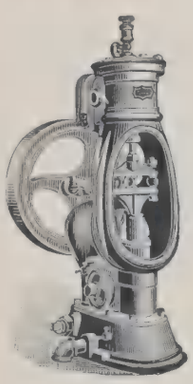
AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . .

PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

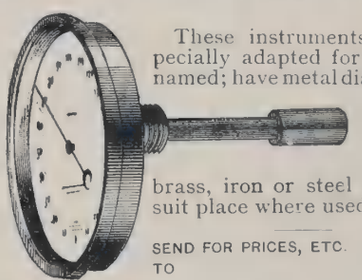
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes.
Etc., Etc.



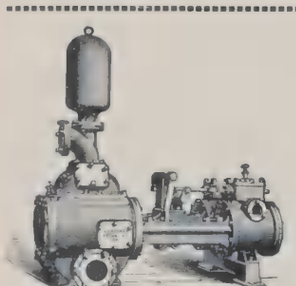
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



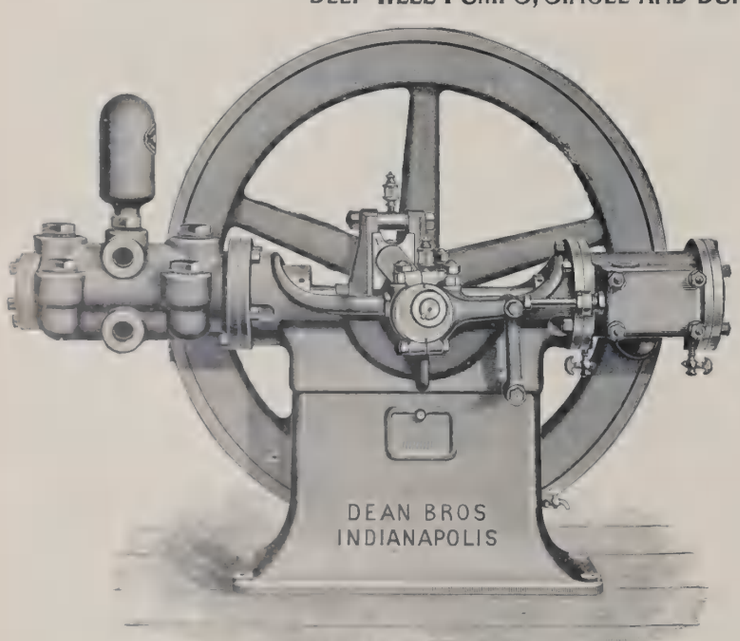
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

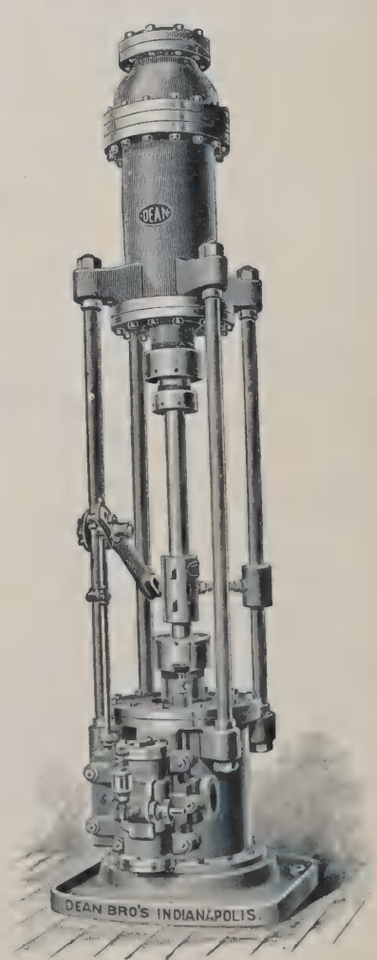
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

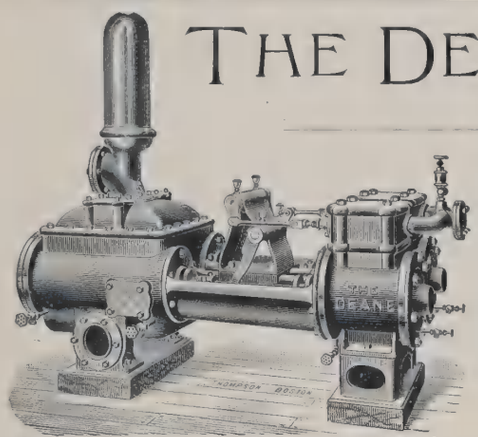
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's Patent Tube Well Strainers

AND

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

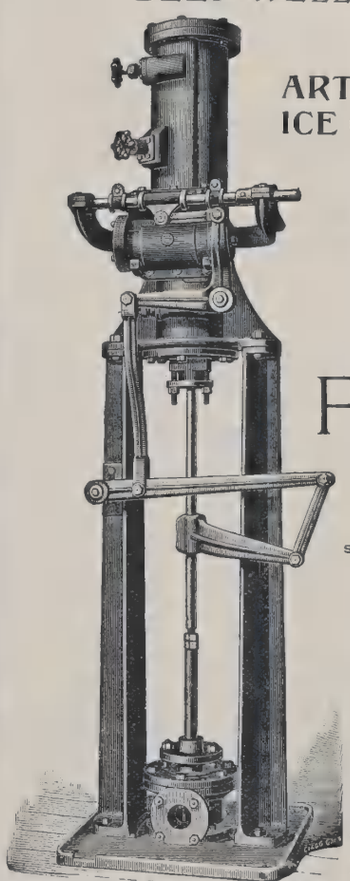
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

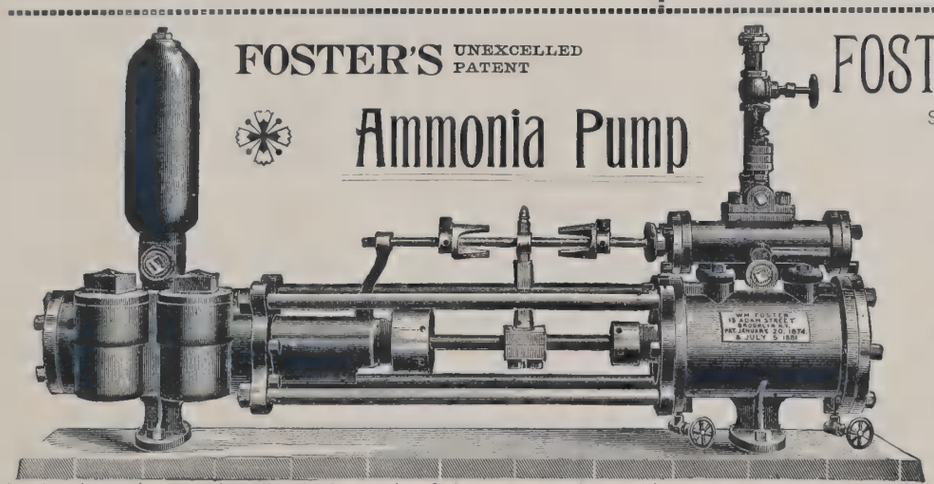
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

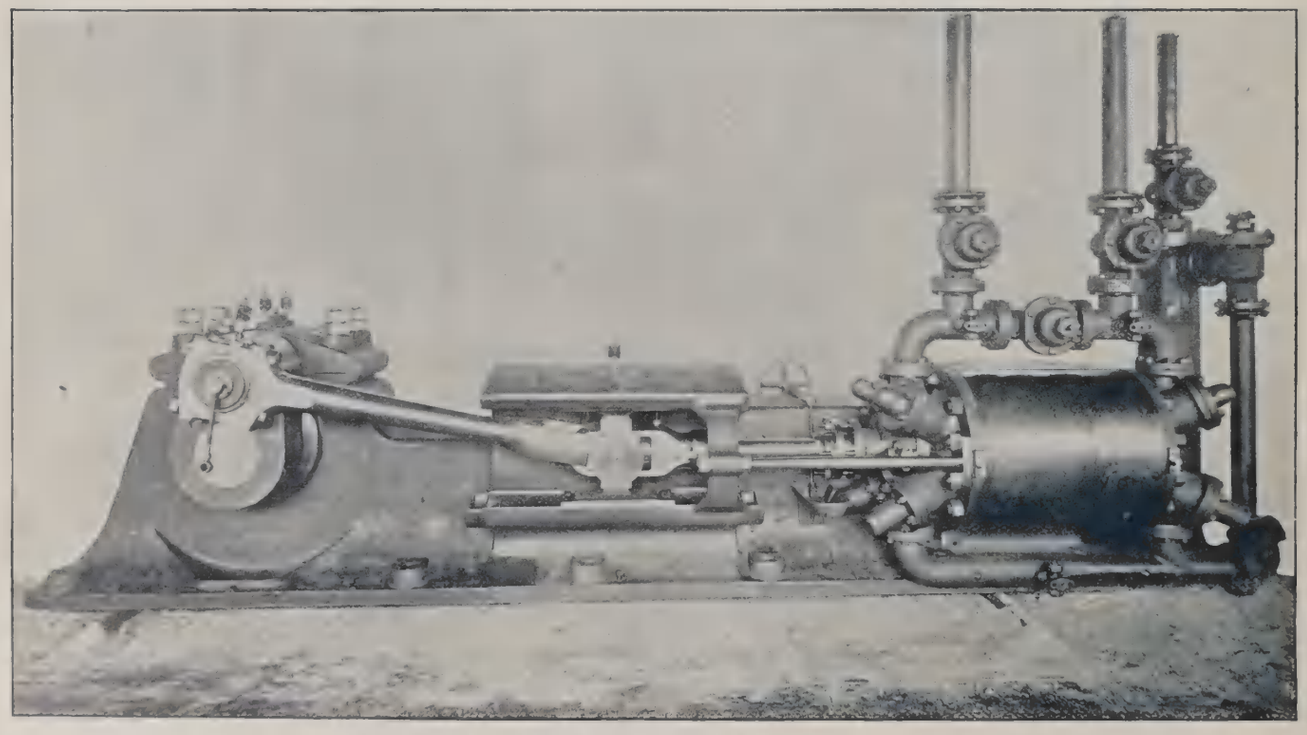
All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.

THE FRED W. WOLF CO.

MANUFACTURERS OF THE

Linde Ice and Refrigerating Machine

560 North Halsted Street CHICAGO, ILL. U. S. A.



No. 8 Linde Compressor, 100 Tons Capacity.

FOR

Correspondence Solicited . . . .

ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. II. NO. 2. CHICAGO : NEW YORK : FEBRUARY : 1892. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

THE ABSORPTION MACHINE.

ITS PRESENT STATUS AND FUTURE POSSIBILITIES—A DISCUSSION OF THE MERITS AND CAPABILITIES OF THE ABSORPTION MACHINE—A CRITICISM.

BY JOHN E. STARR, M. E.

The dollar of the average American manufacturer of machinery is a nimble one. It does not wait for the delay necessarily accompanying the development of a particular kind of machinery to a point of nearly ideal perfection. "Money is round, and rolls away," says the capitalist to the artisan; "interest is high; we must keep pace with our flying coin, or it will get away from us. Here is a demand; produce for me a machine that will supply it; something that will 'do.' Never mind what you think you can do, or what should be done. It will take time to realize your ideals, and time is money. Put in concrete form your present ideas, and do it quick."

When the financial possibilities of supplying the demand for refrigerating machinery became apparent in this country, the evolution of the appropriate machine was marked by that great progress that characterizes all American excursions into the field of profitable applied mechanics. It is true that empiricism has abounded, as in all new mechanical enterprises; that "startling discoveries" and the "rule of thumb" were prominent elements. Plans that would "revolutionize the entire refrigerating business" were frequently heard of. But these were incidents, immaterial except for the amusement they perhaps afforded. The real progress of the art, after the great impulse it received some years ago, has been rapid but steady. It cannot be said to be unusual that in this particular field, pushed by that commercial spirit which asks for quick cash results, the true engineer should seize the material nearest at hand, and while we cannot but admire the achievements in the development of particular types of refrigerating machines, it may be well to pause for a moment to consider if it is not possible that the line on which some of these great advances have been made is, after all, fundamentally the proper line to work on.

Confining ourselves strictly to the genus "NH_3" of refrigerating machines, and contrasting the two prominent species, the absorption machine and the compressor, may it not be said, as an introductory, that the majority of the practical engineering talent in the line of applied mechanics in this country was of a kind that had to do with the development of the steam engine and the machinery driven by it? The transformation of heat into mechanical energy by cylinder and piston devices, as in the steam engine and pump, the transmission of power by crank, belt and cog, and all the problems connected therewith, brought out by the mechanical demands of the age, constituted the larger part of the mechanical engineer's experience. The scientific libraries were full of the record of experiment and practical results in this line. The natural laws governing in such devices were well known, and fully explained to the minutest detail. Experiments and results were tabulated, compared, sifted and discussed by the brightest minds, so that the economical possibilities were shaded to a nicety.

Much of this material was directly applicable to the development of a refrigerating machine of the compressor type. It was not necessary to explore new ground, or by original experiment to establish new data. The necessary material was already at hand, and its application was a matter of comparatively short time. Naturally, then, the development of the machine went in the line of what seemed to be that of the least resistance, and the compressor type is the result. Hand and hand it has gone with the development of the steam engine, and so will it go in the future. On the other hand, the absorption machine was out of the line of the majority of engineering experience. The same general laws, of course, governed, but the detail was largely missing, and parallels were lacking in other portions of the mechanical field. There were no tables, giving the pressures of various strengths of ammonia solutions at various temperatures; no exact experiment as to the amount of heat required to separate the gas from the water at various strengths of solution and pressure; no exactly established coefficient of solubility; no precise tables as to temperatures required for dehydration,—in short, nothing but very general and more or less incorrect data to build upon from one end of the process to the other. Considering the dearth of such exact information, it is remarkable that the absorption machine is in as good a condition as it is to-day. It also seems as if the development of this particular type of ammonia machine was more than usually hindered by the connection of charlatans who brought to it that excessively "dangerous thing," a "little knowledge." Nor is it to be wondered at that, looking back over a record of comparative success, the partisans of

the compressor, knowing but little of the possibilities of the other type, should take an attitude of complacent admiration of their work, and say further that, "No good thing can come out of the Nazareth of the absorption machine."

A fair illustration of this attitude may be made by quoting from the article recently appearing in this journal, written by an able mechanical engineer, engaged in the building of compression machines. After saying that, "There are but few persons that are not convinced of the inferiority of these machines [absorption] as against compression machines," he explains fairly the operations involved, showing the course of the gas to the point where it is "absorbed by the same water out of which it had been driven at the beginning of the process." "To make possible this absorption," he continues, "the water must be cooled down from that high temperature to a far lower one, and this causes a considerably higher consumption of cooling water than in compression machines. Besides this quantity, these machines need the same water the other systems need in the ammonia condenser; and, secondly, this new formed ammonia water must be again heated to drive out the gas, and as the quantity of water *is about twenty-five pounds for each pound of gas it has absorbed,* one readily sees that a considerable loss of heat is caused by this heating of the absorbing water. You will notice that this amount of heat by no means corresponds to the work needed for the compression machines; thereto corresponds only that amount of heat which is used in the absorption machines to heat the ammonia itself, and to give it the pressure needed for liquefying it. Besides, there is still another loss in the absorption machines caused by the fact that you cannot utilize the expansive power of steam as you do in the steam motors of other systems."

The high reputation of the writer quoted precludes the slightest suspicion that these statements are not made in perfect good faith, and that there is any attempt at willful misrepresentation. The statements as they stand, however, could hardly be made more misleading or erroneous.

The action of an exchanger, in a properly constructed absorption machine, cools down the weak aqua from that "high temperature" to an amply sufficient low one to receive the gas, and in so doing gives its heat to the new formed ammonia water on its way to the still; so there is not the loss of heat indicated in the quotation. In a good machine the cooling water used to take up the heat liberated during absorption is the same water that was previously used on the condenser, and a properly constructed absorber needs hardly the same amount that it is necessary to use on the best type of condenser, taking it at the temperature it leaves the condenser, and carrying it through a wide range of higher temperature, as we shall presently show.

It is not necessary to use a single pound more of water in the absorption machine than in the compressor.

The statement that the quantity of water (weak aqua) is twenty-five pounds to absorb one pound of gas, is a still more forcible illustration of the position. The poorest absorption machine we have ever heard of works from a solution about 29 per cent strong to one about 13 or 14 per cent strong, thereby giving out about eighteen pounds of ammonia from each 100 pounds of solution, or about six pounds (instead of twenty-five) of solution to each pound of ammonia; while good absorption machines will work from a solution containing 33.25 per cent of ammonia to one containing 10 per cent, or 25.84 pounds of ammonia from each 100 pounds of strong solution; and better results than these can be obtained.

The amount of heat eliminated at the absorber, and the amount of heat used to disassociate the ammonia from the water in the still, find their parallel in the compression machine in the energy wasted in the prejudicial frictional resistance of the engine and pump, and in the loss of about 900 units to each pound of steam liberated in the exhaust of the engine, or in heating the water in the steam condenser, if a condensing engine is used—a parallel, we expect to be able to show favorable to the absorption machine.

The writer quoted seems to lose sight of these losses in the compressor in making his comparisons. In view of the plain inaccuracy of the statements quoted, the closing remarks on the absorption machine in the article mentioned are as refreshing as the cool, salty breath of the brine tank. It says: "But it must not be forgotten that the absorption machine played a very important part in the development of the ice machine, although their day of general usefulness is now past." Let the decrepit absorber for this much give thanks.

Another phase of the position occupied by the developers of the compression type of machines, as well as an indication of the feeling that the compression machine has well nigh reached the limit of its development, is well illustrated by the printed statement of an association of the most prominent workers in the field, whose productions are marvels of finish and engineering skill. After very properly and very deservedly congratulating themselves on their admittedly great achievements, they say: "We believe that we have completely mastered the subject; at least, we cannot at this time see in what respect we could improve these conditions. Practical results agree so remarkably well with the theory that we know we are right."

Considering their high engineering ability in their particular line, the statement quoted is doubtless true. They have mastered the subject of the compression machine, but have they mastered the subject of the absorption machine?

A glance at the chapter devoted to the absorption machine, in the pamphlet from which the above is quoted, shows merely a repetition of statements of adverse conditions that do not exist in the properly built absorption machine of the present day.

It is far from our purpose to decry the compression machines, nor is it our intention to claim that every absorption machine is as good or better than a compressor, or is even a good machine. There are plenty of mighty poor absorption machines, and, for that matter, of compressors also. It is the thermodynamic advantage of the special type that we desire to present, using the compression machine merely for the purposes of comparison.

We shall endeavor to show that to-day a well designed machine of the absorption type can be made fully as efficient as to coal and water as a well designed compression machine, and under most practical conditions more efficient, and that even at this stage its development

is not yet finished, and the probability of further improvement is strong; and, further, to indicate on what general lines the machine should be built, in order to attain its greatest efficiency. In the discussion of the subject we shall endeavor to avoid, as far as possible, the use of algebraic equations, preferring to use, step by step, actual quantities by arithmetical processes, as we feel that such a method will be more acceptable to the general reader. (TO BE CONTINUED.)

[*Written for* ICE AND REFRIGERATION.]

APPARATUS FOR MAKING CLEAR ICE.

CONTINUATION OF THE SUBJECT FROM THE JANUARY NUMBER—SOME FURTHER DEVICES SUGGESTED, CHIEFLY IN USE BY FOREIGN ICE MAKERS.

[*Continued from January issue, page 37.*]

Continuing the exposition of certain minor devices for making clear ice, we present this month some apparatus proposed by ice makers on the Continent. Figs. 5 and 6 show a stirring device, with up and downward movement. Into every freezing cell a rod passes centrally; at the lower end these rods are provided with strong round or square rubber plates. All rods pass through boxes in the fixed cover of the generator and are fastened into common rods by sections which are connected among each other by two longitudinal cross-pieces. These cross-pieces are kept in position by four and more guides and connecting rods, and are moved up and down by means of a system of cranks or levers. The rubber plates of the first section have the largest diameter,

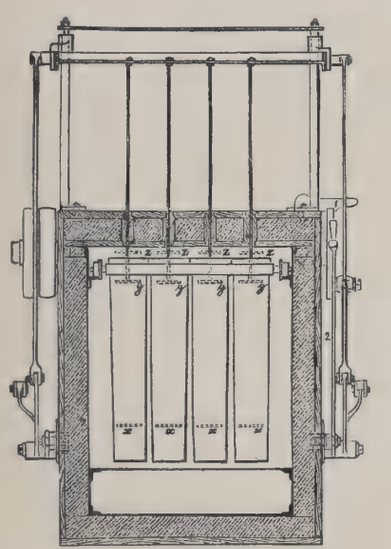


FIG. 5.

because no ice is formed in that section until it becomes a section further advanced toward the opposite end of the generator. The diameter of the plates, for the same reason, becomes smaller in those sections as the formation of ice increases. The rise of the rods and plates is so arranged that at their lowest position the rubber plates are at a distance from the bottom which equals about one-half of the thickness of an ice block, while at their highest position at *y* they are a little below the top level of the cells.

If a section is to be removed from the generator and to be replaced by another one, the stirring is interrupted and the crank disk brought to the position shown in drawing by means of the check hook 1, while the lever 2 is pressed downward. In this way the whole system is lifted, since the levers 3 of the frame are fixed to the levers 4; in this way all the rubber plates are lifted above the rim of the cells into the position *z*, after which the sections can be shifted ahead.

Another device for the same purpose is illustrated in Fig. 7, which has been designed by Kropff. It contemplates a continuous movement of the water in the freezing cells. An air pump connected at *d*, Fig. 7, by means

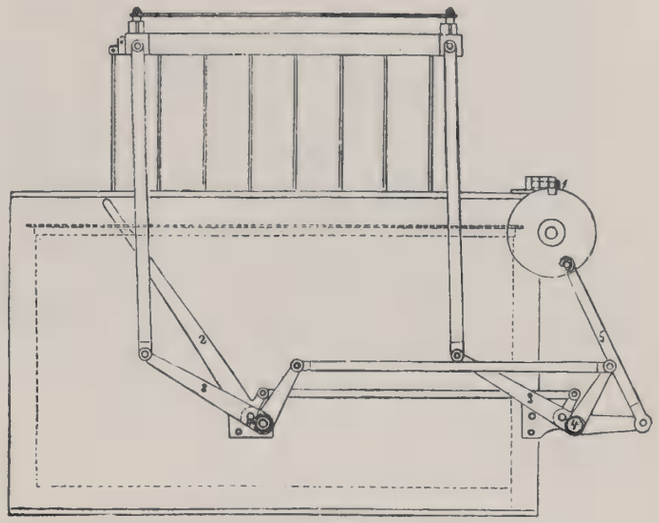


FIG. 6.

of a connection *b* draws the water from the freezing cells *d* partially into the vessel *c*. By constant and alternate turning of the cock *e* air is allowed to enter into the vessel *c*, whereupon the level of the water contained in the same is lowered again, returning to the freezing cells. By the continuous movement of the water in this manner it is intended to remove the air. A similar device has been designed by Mackay, of Liverpool.

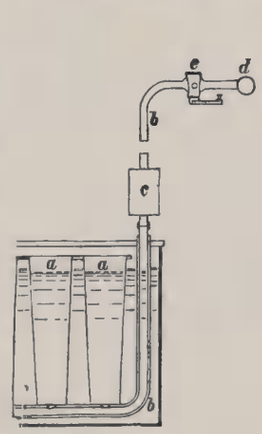


FIG. 7.

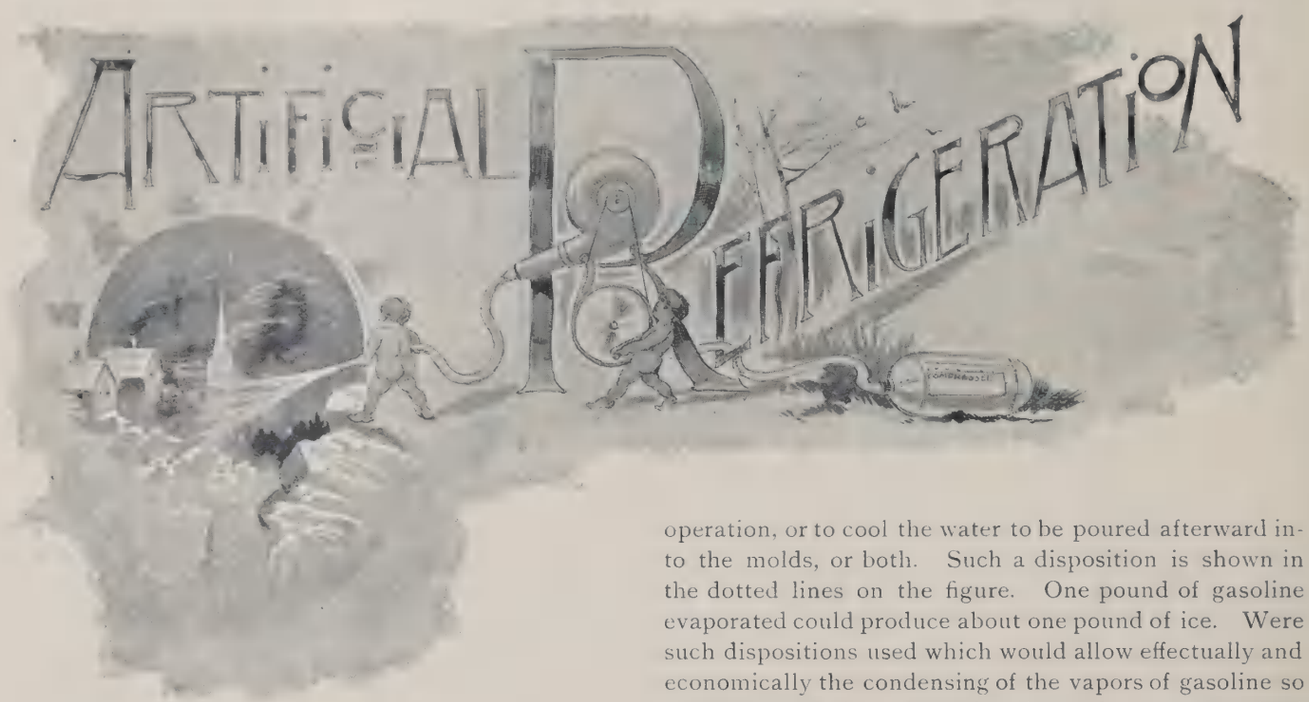


FIG. 8.

P. Effertz (Chemnitz) contemplates the achievement of the same object by suspending pieces of hose in the freezing cells, as shown in a sectional view in Fig. 8. These pieces of hose are provided at their lower end with a suction valve *v*, and at or near the center are provided with pressure valves v^1 and v^2, arranged by means of rubber rings. In this manner a pump connected with the upper end of the hose draws the water in *v* and discharges the same at the pressure valves, thus causing a circulation of the water in the freezing cell.

THE butter and cheese men of Indiana, to the number of forty leading men, met recently at Indianapolis, to form an organization for the protection of that trade in the state. The organization is called "The Butter and Cheese Makers' Union of the State of Indiana," and officers chosen were, W. H. Dye, president, Indianapolis, and M. M. Binford, secretary.

MERCHANT & CO. have just issued a novel and unusually attractive pamphlet, descriptive of the specialties sold by them, entitled, "What Visitors will be Shown at the World's Fair by Merchant & Co.'s Brownies." It is beautifully printed, and is illustrated by twenty exceptionally clever, humorous half-tone cuts showing the nations inspecting Merchant & Co.'s exhibit and the Fair in general. It is safe to say those who get a copy will "hang on to it" for the clever designing at least.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—THE SMALL ICE MAKING MACHINE OF T. DU MOTAY AND ROSSI—SOME FURTHER DEVICES OF INTEREST.

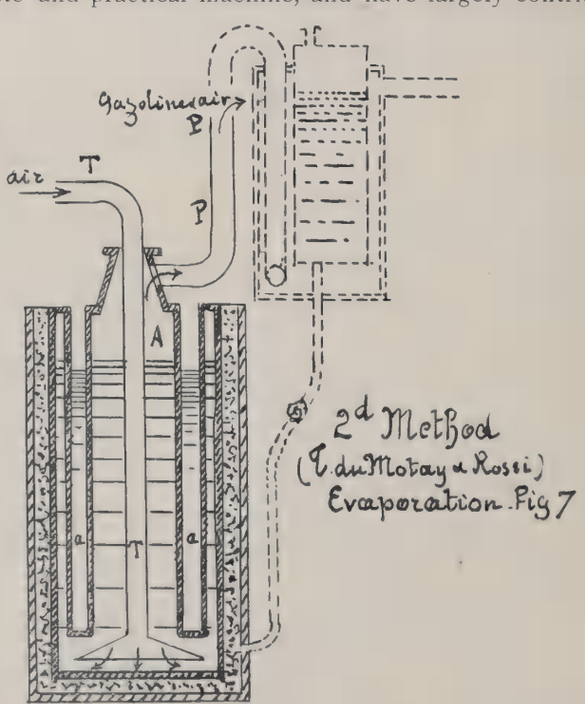
BY AUGUSTE J. ROSSI, B. S., C. E.

[*Concluded from January issue, page 20.*]

In 1880, we find also the practical application of another of the principles mentioned at the beginning of this examination (second method), the spontaneous evaporation of a liquid, such as water, or, preferably, one more volatile than water, by the passage of a current of air. (T. du Motay and Rossi). In this case the liquid used was gasoline, the price of which is cheap enough (about one cent a pound) to allow, within certain limits, of its being wasted after having produced its cooling action, at least for machines intended, as those were, for the limited production of five to ten pounds possibly per hour for family purposes in special circumstances. Five pounds of ice can readily be made in an hour with a model fifteen inches in diameter and about twenty inches high. The working of the method (Fig. 7) is obvious:

The gasoline having been filled into the vessel *A*, a tin cylinder of the shape indicated in the figure (properly insulated by a non-conducting covering), molds *M M*, containing the water to freeze, are placed in the cylindrical cavities *a a a*, in which they fit loosely, the contact being made more perfect by pouring in the cavities a small quantity of uncongealable brine. Air is then passed through the central tube *T*, being forced in by a small hand blower; and, bubbling through the mass of gasoline, it evaporates it, this evaporation producing an intense cold in the liquid contained in *A*, cold which, being transmitted to the water vessels, ultimately freezes the water to ice. The air charged with vapors of gasoline, which escapes through pipe *P*, is, of course, at a very low temperature still. It can be either allowed to waste or the cold made available to cool, in another vessel before escaping finally, the gasoline necessary to replenish the quantity evaporated from *A* for another operation, or to cool the water to be poured afterward into the molds, or both. Such a disposition is shown in the dotted lines on the figure. One pound of gasoline evaporated could produce about one pound of ice. Were such dispositions used which would allow effectually and economically the condensing of the vapors of gasoline so as to separate them from the air as they escape mixed with the latter, and that without unduly complicating the mechanism, of course the cost of ice could be considerably reduced.

In the meanwhile, new effective devices were invented; machines already introduced perfected; improvements were realized in all their parts, in their mode of operating, improvements which, in many cases, have made of a rudely constructed apparatus at first an elaborate and practical machine, and have largely contributed to bring artificial refrigeration to what it has become in our day. We could quote among many others the De La Vergne, Mixer, Boyle, Ballantine, Allen, Giffard, Rankin, Linde, Windhausen, Kropff, Holden, Kline, Cook, etc., patents which all mark steps in the line of progress; but, as they do not involve the application of any *new principle* to refrigeration, we have to limit ourselves in this examination to a mere mention of names.

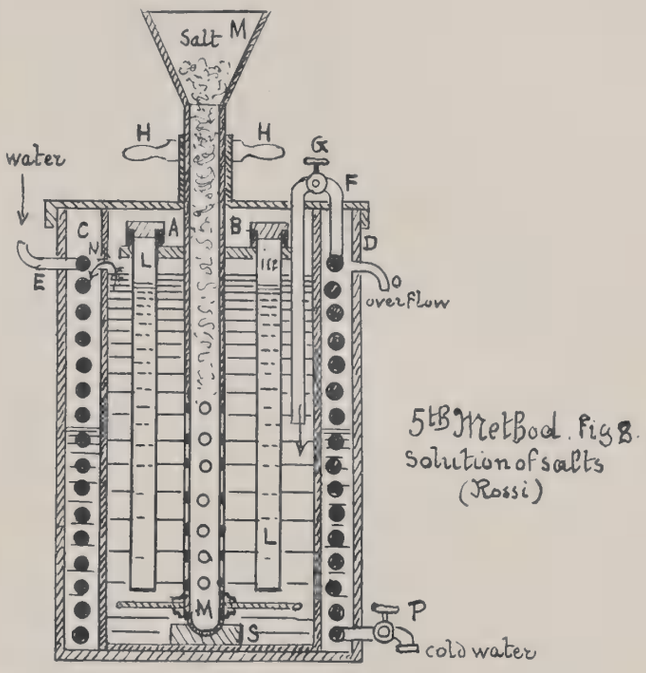


In 1885, we find a patent by Franz Windhausen covering the application on a large scale of the third method mentioned: The evaporation of water *in vacuo* promoted by the absorption of the aqueous vapors as fast as formed by a suitable absorbent, such as sulphuric acid. It was, in fact, the practical reproduction of the experiment of Leslie. The ordinary pneumatic pump of laboratories is replaced by an elaborate vacuum pump exhausting the air over water, which is allowed to drip slowly in thin films into large cylinders in which the ice is formed, the vapors given off being at the same time brought in contact with concentrated sulphuric acid contained in a special reservoir in which they are absorbed as fast as formed; the apparatus being so constructed, in later improvements, that the sulphuric acid which by absorbing the aqueous vapors thereby loses gradually its capacity to absorb more, is concentrated as fast, or nearly as fast, as diluted.

As early as 1865, Edmond Carré, of France, had patented a small machine working on the same principle, and intended to be used for small productions of ice for family uses or for freezing *carafes*—an application which was practiced in France with this device for many years. It bears to the large machine of Windhausen the same relation as the intermittent absorption ammonia machine of F. Carré bears to his continuous apparatus, and as such F. Carré should be mentioned as the pioneer of such application. Both these machines, the large as well as the small one, having been described in detail in the issue of this paper for August last, with cuts illustrating their main features and mode of working, we refer the reader to that section of this article.

In 1884, we find a practical application to refrigeration of another of the principles enumerated at the beginning of this article (fifth method). It is based on the property possessed by certain salts of producing a great lowering of temperature by their being dissolved in water. As early as 1855 and, later on, in 1859, Siemens in England, and in 1868 Toselli, and after him others in Europe, had taken out patents on the same subject. Of these apparatuses, that of Siemens was never introduced in practice, so far as we know, if it ever was built; and those of Toselli and others were so limited in their production of ice or cold water and possibility of use on a larger scale for such purposes, that as a type of such contrivances, it may be proper to describe the following as better embodying the distinctive features of the process.

As we have had occasion to mention, when certain salts are dissolved in water, a great depression of the temperature of the mixture is observed. For instance, if in a certain weight of water at 80° F., we dissolve (promoting the operation by stirring the mixture) an equal weight of nitrate of ammonia, the temperature of the solution is found to have fallen in a few minutes to 40° F., more or less, or say, though a range of 80° minus 40°, or 40° F., more or less, as there is a loss of cold on account of the radiation by the glass if not insulated. Such cool mixture at 40° F., though available to cool a certain body of warmer water, could not be used to make ice; but if by some practical and cheap disposition the fresh water in which the nitrate of ammonia is to be dissolved can, previously to the addition of the salt, be cooled to say 35° or 40° F., it is obvious that the addition to such fresh water at 40° F. of a proper weight of nitrate of ammonia, by causing a depression of temperature of the mixture amounting to some 40° F., will furnish a solution at a sufficiently low temperature for purposes of ice making. The operation is conducted as follows (Rossi's patent, 1884–1889):



In a wooden vessel *C D*, properly insulated or not, there is placed another vessel *A B*, also in wood, the annular space between the two vases being provided with a tin coil *E F*. The coil *E G* bends upward, and when required can, by the opening of a valve *G*, discharge its contents into the interior vessel *A B*; the contents of this latter vessel when reaching the level *N*, can overflow in the annular space in which is the coil *E F*. Inside of the vase *A B*, and properly secured in their vertical position, are set two or more tin cans *L L*, in which is filled the water to be frozen. A sort of funnel-shaped wooden pipe *M*, perforated in its height from the bottom, allows of the charging of the salt. It is guided at the top by proper wooden guides provided on the cover of the apparatus or otherwise, and bears at the bottom on a wooden socket *S*. By means of the handles *H H*, this salt feeder can be moved to and fro so as to produce an agitation of the contents of *A B*, intended to promote the solution of the salt in water, as we will see further on.

The cock, or valve, *G*, being closed, water is filled into the coil *E F* from a superior reservoir or from a hydrant, as the case may be. Some nitrate of ammonia is then thrown in the annular space, and fresh water added in this space. The cooling effect obtained by the salt being dissolved in this water rapidly brings down (in three or four minutes) the temperature of the water *inside of the coil* to 40° or 45° F., more or less. If, then, some salt having been thrown through the funnel pipe *M* in the interior vase *A B*, the cock *G* be open, this cold water from the coil, falling on the vase *A B* and dissolving the salt at the bottom, the temperature of the mixture soon falls to 10° or even 5° F., and by contact with the sides of the cans *L L* the cold generated in *A B* gradually freeze the water they contain. More salt is then added in *A B*, as well as more cold water allowed to flow from the coil, and the vase *A B* ultimately fills up to the level of the overflow *N*. The

operation is then abandoned to itself, the mass being stirred and mixed from time to time by moving to and fro the salt feeder pipe *M*. If thus more salt is added in *A B* (which depends on the manner in which the freezing proceeds in the cans), the cold brine from *A B* overflowing in *C D* cools to a greater degree still the water in the coil *E F*, and by admitting this water in *A B* a further depression of the temperature takes place in this vessel. In about one hour from the beginning of the introduction of the water in *A B* the water is found frozen in the cans, the quantity of salt and water added and the relative dimensions of the different parts are, of course, proportioned to the amount of ice made. If the ice to be formed is kept within a thickness of one to one and one-eighth inch quantities of five pounds, ten pounds, twenty-five pounds and even more pounds can be readily made in one hour in cakes weighing from two and one-half pounds to six pounds each, according to the capacity of the machine.

This apparatus was intended by the inventor for intermittent action. Were it found advisable and economical to continue the operation after one hour, the ice having been removed from the cans and fresh water filled in them, more salt would be added through *M* in *A B* and more water admitted from the coil, the cold brine overflowing from *A B* in *C D* at *N* furnishing all the cold water required, and another batch of ice could be made, the solution from *C D* overflowing in its turn in proper barrels, the brine remaining in *A B* after the removal of the ice is still cold enough to cool *carafes*, or bottles, and, if the coil *E F* is provided with a drawing-off cock opening outside, such as *P*, cold water can be drawn from it for drinking purposes. Proper valves allow evacuating the vessels *A B* and *C D*, and the solution being evaporated will furnish the regenerated salt for subsequent operations.

We do not examine here the economy of such evaporation or take in consideration the possible losses or alterations of the salt during this evaporation, if carried on on a *large scale*. As contemplated by the inventor, the process was intended for the production of ice and cold water *in limited*, though sufficiently *important quantities for domestic purposes*, in such places where the natural product cannot be obtained at all, or only with great difficulty and cost, in a comparatively very cheap apparatus, and in cases where other machines, however more economical, could not be thought of owing to their cost and other causes.

A RESUME OF THE TOPIC.

We desire to make here a general statement which applies to all that we have said above. Our intention has been from the beginning to expose and describe, as succinctly as possible, the various *distinct* methods which may be used for artificial refrigeration *as far as they are based* on one of the different principles enumerated at first. We have done it, following the chronological order, as far as practicable, and as we have found such processes described in the succession of United States patents, dwelling a little more at length in our description on such ones as are perhaps comparatively less known. But we wish it to be clearly understood that in so doing, and at no time in the course of this examination, did we have the intention of *recognizing* any one system in preference to another, or critically discuss their relative value. We have quoted the names of certain patentees only as far as their names were connected with the application of a distinct and special principle merely for this reason, however economical, on a large scale or not, or valuable in practice these inventions might be or might have proved. Many are the names of those we have been necessarily obliged to omit, or of others we have given but a passing mention, in order to keep within the limit to which we have assigned this examination; and among them are the names of inventors who, by valuable improvements, devices and contrivances, by perfected mechanism, have largely contributed to bring artificial refrigeration to the high rank it has reached in the industries of our day.

The year 1884 brings us to the end of our task. From this date we find only patents referring to improvement relating to the different types of machines previously described, but not involving any new principles. Summing up the above, we see how rapidly after the physical laws and properties of matter began to be better known they received scientific as well as practical applications. We see, as early as 1835, the first machine producing cold by the evaporation and compression of the vapors of volatile liquid, soon followed by the air machine, based on another principle. For many years these two methods are the only ones resorted to and the only ones to receive improvements. Gradually other principles furnished a new field to inventors; new processes make their appearance, the development of the mechanical arts, of chemistry in all its branches, of metallurgy itself, paving the way to successive improvements in the apparatuses adopted, and the requirements of industry opening new fields of usefulness. From 1835 to our day, each inventor may be said to have contributed a stone to the construction of the edifice which stands now on a firm basis and asserts more and more every day its value and importance by applications in directions least expected.

The application of artificial refrigeration to the freezing or cooling of liquids or other substances for specific purposes; to the conservation of perishable articles, such as meats, fruits and provisions of all kinds in special buildings (cold storages, packing houses); to the maintenance of proper temperatures in cellars, brewery vats and the like; to the preservation of fermenting juices, or liquids, could be foreseen, once in possession of means by which artificial cold could be economically and industrially produced. That it could find a further field of usefulness in chemical factories was also to be expected, knowing that in such works a certain temperature is in many cases a necessity of production. Later on it was even found to be of great service in separating certain salts from their solutions by freezing the dissolving water or in separating other substances from their relatively uncongealable solvents. Aware, as we are, that an excessive state of moisture of the air renders it little available for purpose of drying, it could be also inferred that by freezing out, or condensing by cold, this moisture, such air, thus rendered perfectly dry and being further heated, could be used for purposes of rapid desiccation—a condition of paramount importance in many circumstances, for instance, for the drying of gelatined bromine sensitized plates for photography.

All these applications and many others, of which we may have occasion to speak at another time, were within the possibilities of the future; but little was it thought,

when the first timid attempts at artificial refrigeration were made, and even much later on, that refrigeration could and would become the only resource of the engineer, furnishing him an economical, efficacious and absolutely satisfactory solution of one of the most difficult problems of construction and that, too, where all other means had failed. The congealing of ground in quicksand soils for the sinking of shafts and building of piers in particularly difficult and dangerous conditions is currently practiced in our day, both in this country and in Europe; and we intend, at some future time, to give a description of the methods used, furnishing on this important subject numerous data collected from the practice with this process in different countries.

THEORY AND PRACTICE.

To the Editor: Your reply in last month's issue under this heading places me in the position of the boy at the bottom of the class, who, alarmed at the indignation of the teacher consequent on failing to get a satisfactory answer to his question, "Who made the world?" exclaimed, "Please, sir, it wasn't me." On calm reflection, the youngster probably felt flattered by the supposed imputation. In like manner, I cannot repress a certain satisfaction at your evident intention to attribute to me the method used in calculating the refrigerating effect of ammonia. I could hardly have been more flattered had you credited me with originating one of the four rules of arithmetic.

My intention was to uphold the credit of our journal for accuracy on technical questions, but from your reply I see I have been *plus loyaliste que le roi*. Though idiots of this class are entirely undeserving of sympathy, it was somewhat unkind to insinuate that I was on a still hunt for beams and motes. In this connection you have been quite liberal, and, I must in justice add, strictly impartial in the distribution of these obscuring matters, for you first place a beam of no considerable size in my eye, in order to artistically withdraw which it was necessary that Professor Wood should receive a mote of corresponding dimensions.

In my communication I stated most distinctly that "the net cooling effect of one pound of ammonia (is) obtained by subtracting the heat carried into the refrigerator from the *total* latent heat." There is, therefore, no point in your reference to my supposed misuse of the internal latent heat. The confusion probably arose from my objection to your counting the external latent heat twice (as in your first calculation). As regards the formula of Professor Wood, the h_2 is not, as you insist, the total latent heat—for which Professor Wood always uses a different and characteristic symbol—but *is* the total latent heat less the heat carried into the refrigerator, which makes the formula in perfect accord with my calculation.

GEO. RICHMOND.

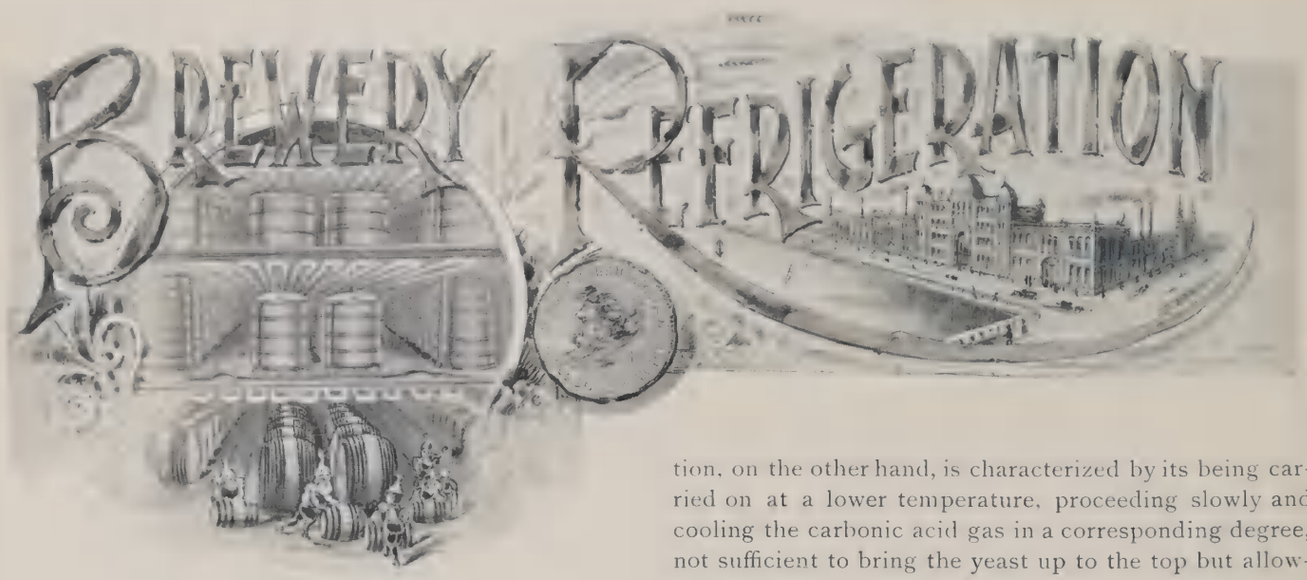
Shorn of its facetious pleasantries the above agrees with the views expressed in our last reply, excepting that portion which applies to the meaning of h_2 in the formula cited by Wood. On closer examination we find that this sign is indeed not meant to include that amount of refrigeration absorbed by the ammonia to cool itself, as it were. While this does not affect the argument which we made in favor of including this amount in the theoretical capacity, we nevertheless cheerfully accept the correction, since it demonstrates that previous usage and perhaps better judgment have already disposed of the question here involved. The misunderstanding was due to the great similarity of the signs h_2 and h_e, their difference having been overlooked in the hurry in which the reply had to be made. Mr. Richmond's original correspondence having arrived just before the forms of the issue were to be closed.

It is readily apparent that any other differences in the solution of the original example can only be produced by the assumption of back pressures different from that assumed by us, a point which was sufficiently ventilated in the former discussions of this subject.

THE ice machine for hotels and apartment houses is growing in favor with builders of first-rate establishments of this kind; and among the sales of machines for the month we note two by Ainslie, Cochran & Co., of Louisville, for hotels and one some time ago by the Buffalo Refrigerating Machine Co., for a New York apartment house. The Louisville company have placed one 10 ton machine at the Terre Haute house, Terre Haute, Ind., and two 2-ton machines at the Victoria hotel, Chicago. The machine of the Buffalo company has been installed at an apartment house at Thirty-first street and Madison avenue, where the system extends through the entire structure, from the basement to the seventh story, each tenant having a large refrigerator which is cooled directly from the plant below. Ice in blocks and frozen *carafes* are also supplied for the entire household by the refrigerating apparatus. When one contemplates the advantages of this system over the familiar method of constructing permanent refrigerators in large apartment houses, with a complete circuit of connection with the sewer by means of the drip pipe, with concurrent danger of contamination of the refrigerator's contents by sewer gas, he can only wonder that the latter construction is ever permitted. The tenant should insist on movable refrigerators, at least, if any be provided by the landlord.

A FRENCH correspondent writing from Paris says that a commission of experts under the presidency of General Delambre is busy obtaining information as to the best refrigerating and preserving processes available, with a view to diminishing the enormous supplies of forage necessitated by the maintenance of cattle within intrenchments during a state of siege. The commission is about to open a competition for the best apparatus for the purpose, and the slaughter houses of La Villette have been fixed upon as the site of the competition. This will include also the construction on the same site of premises with a fixed temperature of 40° degrees and a capacity of 2,000 cubic meters for the storage of meat awaiting refrigeration or for the temporary preservation of meat on sale. The commission has already received tenders from various firms, and has appointed a subcommittee to examine the same, the report of which subcommittee was ordered laid before the commission meeting January 15.

SOUND ice one and one-half inches thick will support a man, four inches thick will support cavalry, five inches thick an 84-pound cannon, ten inches thick will support a multitude, and eighteen inches thick will support a railroad train.



[*Written for* ICE AND REFRIGERATION.]

REFRIGERATION IN THE BREWERY.

HOW CHANGES IN BREWING METHODS HAVE AFFECTED THE SCIENCE OF ARTIFICIAL REFRIGERATION—TOP AND BOTTOM FERMENTATION DISTINGUISHED—THE OFFICE OF REFRIGERATION.

By Prof. J. E. Siebel.

If not the history entire of the invention of artificial refrigeration, at least that of its practical and more general introduction, is very closely connected with the more recent progress made in the brewing industry, if, indeed, the history of the latter is not almost identical with a history of the development of the most successful devices for artificial refrigeration. Not that the first applications of artificial refrigeration were made in the brewery, but it was nevertheless the development and the new departures in this industry which first opened the prospect for an immense and evidently profitable field for the introduction of successful refrigerating machinery.

The beer of our ancestors was a domestic and crude product, made by a so-called "top fermentation" and subject to a multiplicity of changes if not consumed within a short time after its production. The factory products turned out at a later period were not much different, except that they were made much stronger and mollified with a variety of drugs in order to insure some degree of stability and character. The desire or, perhaps, the economical and sanitary necessity, to produce a beverage less strong and of a purer character gradually brought about the conviction that nothing short of a fermentation at a lower temperature would fulfill the conditions required for the production of an article uncontaminated and of acceptable strength—a conviction which was necessarily followed by the substitution of a bottom for the top fermentation.

The principal difference of these two fermentations consists in the fact that in the older so-called top fermentation that process proceeded at a higher temperature, thereby proceeding quicker and throwing up bubbles of carbonic acid gas in great profusion and in quicker succession. The latter circumstance also caused a rising of the yeast to the top of the fermenting liquid, hence the name, "top fermentation." The bottom fermentation, on the other hand, is characterized by its being carried on at a lower temperature, proceeding slowly and cooling the carbonic acid gas in a corresponding degree, not sufficient to bring the yeast up to the top but allowing the same to be settled at the bottom.

It is, however, not to be supposed that this change from top to bottom fermentation was effected at once, all the world over. Indeed, there are some countries which still adhere to top-fermented beer, such as England and Belgium; but the recent departures in English brewing incline decidedly toward the methods now generally employed in the production of lager beers. On the other hand, the change was not a sudden one, nor taken in one jump in those countries which now generally follow the bottom fermentation method. The conviction came by degrees, and so did the change, influenced, as may be supposed, by many territorial or even local and individual circumstances, but in every advancing step refrigeration in some form or another was the leading feature.

It may be granted that one of the first steps in this direction was the restriction of brewing to the cooler seasons of the year; another was the building of subterranean vaults in the cool mountain rocks; still later such vaults were supplanted by vaults filled with ice; and later still such vaults were cooled by solutions of refrigerating salts (Velters ob Marseille in 1857), or by a mixture of ice and salt. This last method had indeed been brought to a great state of perfection by our esteemed countryman, W. Voigt, Esq., of Detroit; nevertheless, it also had to make room for the still more improved methods of artificial refrigeration, which culminated in the construction of those gigantic plants which are a just monument to the mechanical skill and enterprise of our time.

The contemporaneous character of these improvements, both in the manufacture of beer and in the production of refrigeration, is, indeed, too apparent to need further comment; the more so since in this, as in most other modern improvements, a good deal of the pioneer work was done on American soil and under our own eyes, as it were. For although the weight and influence of American enterprise in the construction and adaptation of modern ice vaults for the brewery, both with and without the use of salt, is undisputed, it is also a patent fact that several of the more recent plans for mechanical refrigeration were tried on a large scale in this country at or about the same time they were first introduced in Germany on a more or less experimental basis; at a time too, when many otherwise well informed people considered the future of these machines restricted to

fancy ice cream shops and the like. As it now stands, the ice machine has already found its way into all the larger breweries of the land, and it is only a question of a very short time when no brewery in the land subject to the competition of the trade can afford to be without one.

The principal purpose of these machines in the brewery is the reduction of the temperature in the fermenting and storage vaults; and it is not only their economy and convenience which recommend them for this purpose, but more particularly the regularity with which they produce a steady and uniform temperature, essentially below that which can be furnished by melting ice. For it must be understood that uniformity of temperature and a correspondingly low temperature are requirements of paramount importance in the production of a blameless article. In this respect, the superior service rendered by mechanical refrigeration to regulate the temperature of the fermenting wort (by circulating brine or ammonia through coils suspended in the fermenting tubs), over and above the former use of ice floats and swimmers for this purpose, as regards efficiency, convenience, safety and economy, should also be especially mentioned.

Incident to these advantages are a number of others, which are of not less importance. Foremost among these is the better keeping of the yeast under the new method of working—an advantage which can only be fully appreciated by those brewers who have "tried them both." Then, we have a better ventilation, a firmer saturation of the beer with carbonic acid, a more stable, a brighter, lighter and more uniform product, and last, but not least, dry and airy cellars, free from the obnoxious mold and slime so characteristic of many beer vaults of the past.

Moreover, the use of artificial, or mechanical, refrigeration is not restricted to the cellars and vaults, for no sooner has it been introduced for that purpose into a brewery than it is also made use of to hasten the cooling of the wort to the temperature of pitching, which is a comparatively tedious process by the old method, and one subjecting the wort to more or less bacterial contamination, which danger is reduced to a minimum by the application of artificial refrigeration. So important is the use of artificial refrigeration for this purpose that many large breweries have special machines for this purpose only.

In connection with the above it should also be mentioned that very extensive and, in a manner, successful efforts have been made to make artificial refrigeration a standing factor in the production of malt, both to insure a pure, germ-free product, and to enable maltsters to produce this article all the year round. There is certainly nothing, as far as we can see, to prevent the consolidation of the material advantages offered by refrigeration and many features of pneumatic malting to bring about this desirable end in a most satisfactory manner.

BREWERY REFRIGERATION NOTES.

——The Eagle Brewery, Elgin, Ill., began cutting 8-inch ice January 11.

——The Fort Worth Brewing Association will erect a storage house at Greenville, Tex.

——The owners of the Crown Point, Ind., brewery will put in an ice and refrigerating machine.

——The Val. Blatz Brewing Co., of Milwaukee, is building a cold storage house at Superior, Wis.

——The John Gund Brewing Co., La Crosse, Wis., has recently put in a complete refrigerating plant.

——The Ruff Brewing Co., Quincy, Ill., during 1890 put in an ice and refrigerating machine costing $16,000.

——M. & E. Muessel have contracted with the Western Ice Machine Co., of Chicago, for a 15-ton refrigerating plant.

——The South Chicago Brewing Co. have bought a 50-ton refrigerating machine from the Western Ice Machine Co.

——The La Salle Brewing Co., La Salle, Ill., will be remodeled and an ice machine put in for refrigerating the plant.

——The Indianapolis Brewing Co., Indianapolis, Ind., had 500 men at work this month cutting ice at Brighton Beach.

——The Gem City Brewing Co., Quincy, Ill., may put in an ice machine this season and abandon the use of natural ice.

——The City Brewing Co., of Jeffersonville, Ind., will put in a 30 ton refrigerating plant, made by Ainslie, Cochran & Co.

——The West Bend Brewing Co., West Bend, Wis., have purchased a 22-ton refrigerating machine of the York Mfg. Co.

——The Gulf Ice and Brewing Co., Norristown, Pa., has been incorporated by John H. Griffith, William Haywood and others.

——Wm. Sebhardt, of Morris, Ill., is erecting a refrigerating house, the contract having been let to the Western Ice Machine Co.

——The Anheuser-Busch Brewing Association, of St. Louis, Mo., will, it is stated, erect an ice factory and cold storage plant at Temple, Tex.

——The Bartholomay Brewing Co. began cutting 7-inch ice at Rochester early in the month, and have stored a large amount in their ice house.

——The work on the cold storage house of the Buffalo Brewing Co. is about completed, one story having been finished. Later on, two more stories will be added.

——The Anheuser-Busch Brewing Association, of St. Louis, Mo., has concluded arrangements for the establishment of an ice factory and cold storage plant at Waco, Tex.

——The capacity of the ice making and refrigerating machine at Dick Bros. Brewing Co. plant at Quincy, Ill., has been increased to 120 tons per day; and twenty new refrigerator cars have been added to the shipping department.

——The breweries which have recently been equipped with De La Vergne refrigerating machines are: P. & W. Ebling Brewing Co., New York, one 50-ton; Star Brewing Co., Chicago, one 100 ton; Leonard Eppig, Brooklyn, one 100-ton; Bavarian Brewing Co., New York, one 50-ton; Doerschuck & Heinbockel, Brooklyn, one 50-ton; C. A. Koenig, Anburn, N. Y., one 18-ton.

——The Texas Brewing Co., Fort Worth, will in addition to the ice machine already had by the brewery put in another 100-ton machine, and the storage capacity for beer doubled. The ice house attached to the plant will be enlarged so as to hold 300 tons of ice, and as the agency trade of the brewery for the coming season will be enlarged, the facilities for manufacturing ice have been increased, the brewery furnishing all of the ice used by the agencies.

NEW BOOKS.

HANDBUCH DER MECHANISCHEN WAERMETHEORIE. Von Dr. Richard Ruehlmann. Braunschweig: 1885. Verlag: Friedrich Vieweg und Sohn; 8vo, 2 Vols. Paper, pp. 800 and 1,002. Price, 46 marks.

Anent the many inquiries for thermodynamic literature made by our correspondents, it affords us great pleasure to call attention to the above work, which treats in a very comprehensive and able manner on the different phases and features of this important subject. The work is modeled after a similar production in the French language by M. Verdet, but has received many valuable additions at the hands of the German author, which bring the same up to the date of its publication. The first volume opens with two lectures by M. Verdet, which, together with a number of elaborate and interesting notes, cover the field of thermodynamics in a systematic, and also commonsense and practical manner, appealing more especially to the popular understanding. In the other part of the volume the matter is treated analytically, taking ample notice of the various original dissertations by the leading authors, such as Clausius, Rankine, Hirn, Thompson, Helmholz, Joule and others, who have taken an active part in the advancement of this important science. This part of the work also treats on the various thermodynamic curves, cycles, etc., and also disposes of the chief controversies which were indulged in from time to time on this subject. The second volume treats on the molecular theory of heat and the consequences which follow therefrom in regard to the constitution of matter: friction, conduction of heat and sound, etc. This volume also enlarges on the relation of thermodynamics to the other forces of nature, viz.: Chemical affinity, electricity, light, explosive matter, etc., and closes with an interesting history of the development of the science of thermodynamics.



[*Written for* ICE AND REFRIGERATION.]

SHIP REFRIGERATION.

THE HISTORY OF THE DEAD MEAT TRADE THE HISTORY OF SHIP REFRIGERATION—A DESCRIPTION OF TWO FOREIGN COLD AIR MACHINES.

By J. K. KILBOURN.

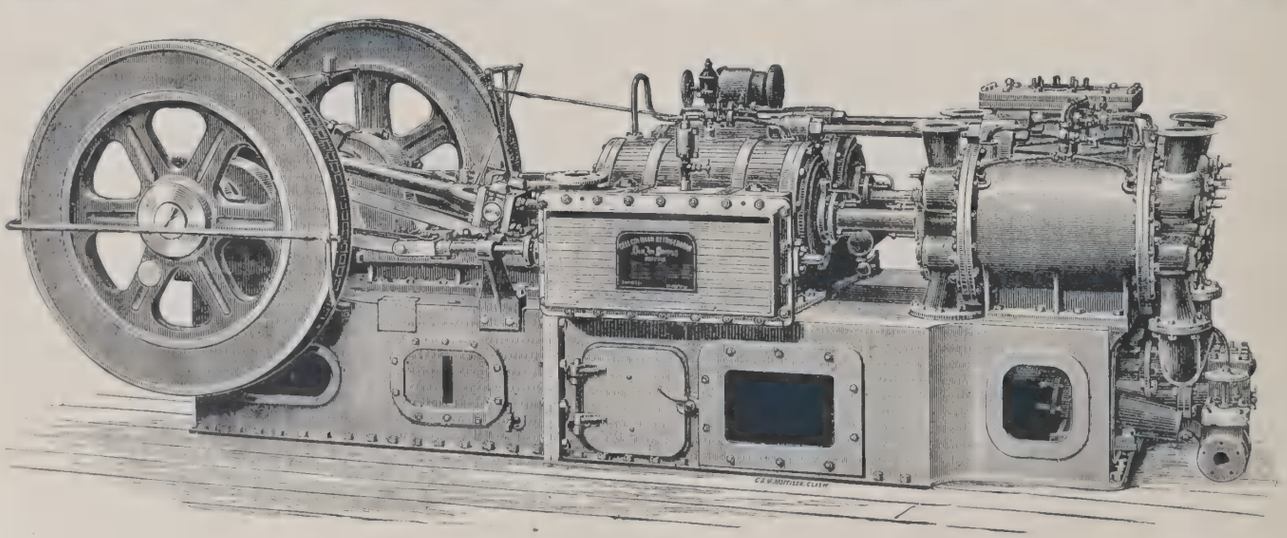
The history of "Ship Refrigeration" is but a recital of the rise and progress of the "Dead Meat Trade" between England and her Australian colonies and South America, and between England and the United States, in every case England being the purchaser.

In February, 1880, the steamship *Strathleven* came to dock in London, having on board about 400 carcasses of frozen mutton, forty-two days out from Sydney and Melbourne. This was the first successful effort in bringing freshly killed meat from Australia under the protection of mechanical refrigeration. The machinery used was what was afterward known the world over as the "Bell-Coleman Cold Air Machine."

The writer was in London at the time, and visited the *Strathleven* two days after her arrival, and was allowed to inspect the machinery and to go into the meat chamber. The data of this article are from notes taken at the time of this visit.

The chamber (26'×26'×6') was dry and sweet, the temperature 20° F. and the meat frozen very solid and apparently in perfect condition. Inasmuch as this system of refrigerating machinery has since occupied a very prominent position in ship refrigeration, a description and illustration of the *Strathleven* machine will not be out of place in this article.

The machine was of the horizontal type, having one 16-inch steam cylinder, two 16-inch compressors and one 16-inch expansion cylinder, all 24-inch stroke. The steam cylinder exhausted into the ship's condenser. The expansion cylinder had a main slide valve and cut-off worked by eccentric with arrangements for adjusting when machine was working. The piston of expansion cylinder was connected to main shaft, and when expanding assisted in driving main shaft. Eccentries were formed by building on to cheeks of main crank. The compressed air was cooled (first) by injection of water into each end of compression cylinders; and (second) by a vertical jet condenser provided with perforated shelves, so arranged that the air passed under each shelf before rising to the next of the series. The air entered the condenser at the bottom and was discharged at the top, in its upward flow through the condenser meeting the water spray in its downward course. From the bottom of condenser the water was discharged through a trap. From the top of the condenser the compressed air was conducted into a series of 2-inch galvanized pipes. This series of pipes, about 300 feet in all, called the "drying pipes," were fixed in a small chamber

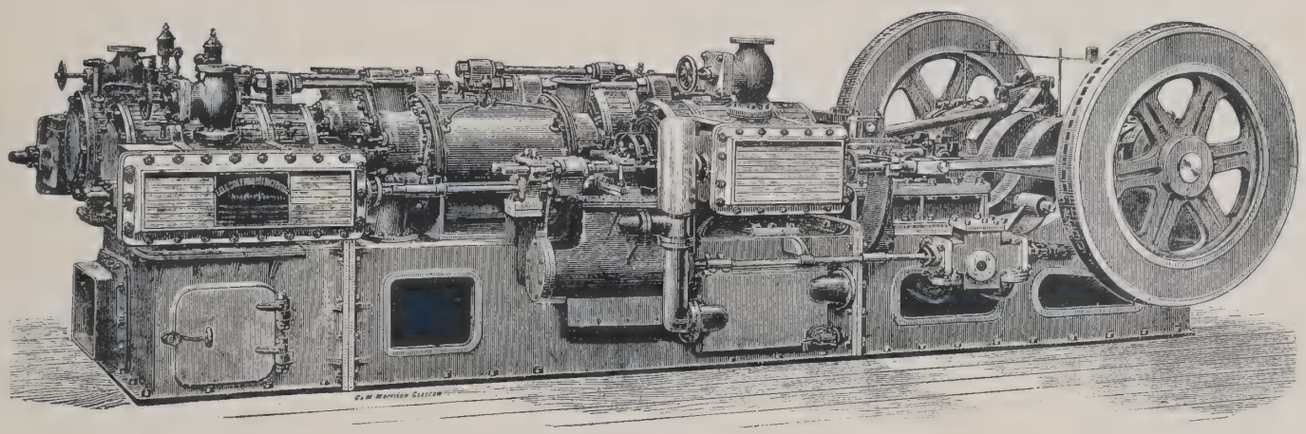


STRATHLEVEN MACHINE—BELL-COLEMAN PATENT.

contiguous to the main cold chamber. This auxiliary chamber was maintained at a low temperature by the passage of the spent cold air through the small pipe chamber on its way back to the compressors. In this way the compressed air in the series of drying pipes was cooled from 8° to 10°. The aqueous vapor set free by compression and by subsequent cooling was deposited on the internal surface of drying pipes; collected and discharged through trap.

From the drying pipes the compressed air was led to the expansion cylinder, and was there expanded against a piston, thus doing useful work, and discharged at a pressure sufficiently above the pressure of the atmosphere to cause brisk circulation into the cold room.

The foregoing description of operation of the machine on the *Strathleven* will suffice for all the cold air machines that have since been built. Improvements in detail have been made (see illustration of a modern-built machine), but there has not yet been found any valid substitute for the valid principle of the Bell-Coleman machine, viz.: Drying the compressd air before expansion.



MODERN BUILT COMPOUND COLD AIR MACHINE.

MODERN BUILT COMPOUND COLD AIR MACHINE.

This machine has two steam cylinders, two air compressors, two expansion cylinders and two water pumps in each machine. The machine is so arranged that one-half of the machine, consisting of one steam cylinder, one air compressor, one expansion cylinder, all are arranged tandem, or on one piston rod, and one water pump. Each half of the machine can work independently of the other half, the crank shaft having a coupling in the center.

The arrival of this small shipment of mutton in good condition demonstrated the possibility of bringing fresh meat from the colonies, and created no little excitement, not only in England, but in the colonies.

Other engineering firms in England and in the colonies undertook the building of machines suitable for this trade, notable among whom were Messrs. Haslam & Co., of Derby; Messrs. J. & E. Hall, of Dartfort; and Messrs. Hicks & Hargreaves, of Bolton. This rivalry continued until 1884, when the Bell-Coleman Co. commenced an action for infringement of patents against the Cunard Co., this company at the time having a "Haslam" machine on one of their ships. The Haslam Co. settled this action by purchasing from the Bell-Coleman Co. all their patent rights and interest in the business. Other firms in England have since commenced building cold air machines, but all have been, I understand, more or less subject to the patents owned by the Haslam Co.

The rapid development and magnitude of the frozen meat trade will be best appreciated by reading the above statistics.

This table shows an increase from 400 carcasses of mutton in 1880 to 3,104,590 in 1890; in other words, for every carcass in 1880 their were 7,761 in 1890. This gain from year to year, and also a general review of the dead meat trade, will form the subject of a future paper.

REVIEW OF THE FROZEN MEAT TRADE—1890.

	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
INTO LONDON:											
Australia	400	17,275	57,256	63,733	111,745	95,051	66,960	88,811	112,214	86,547	210,831
New Zealand			8,839	120,893	412,349	492,269	655,888	766,417	939,231	1,068,286	1,562,647
River Plate				17,165	108,823	190,571	331,245	242,903	169,282	167,936	124,413
Falkland Island							30,000	45,552			10,168
	400	17,275	66,095	201,791	632,917	777,891	1,084,093	1,143,683	1,220,727	1,322,769	1,908,059
INTO LIVERPOOL:											
River Plate							103,454	398,963	754,721	776,000	1,126,531
INTO OTHER POINTS:											
River Plate										66,000	70,000
Total Importations	400	17,275	66,095	201,791	632,917	777,891	1,187,547	1,542,646	1,975,448	2,164,769	3,104,590
River Plate Totals				17,165	108,823	190,571	434,699	641,866	924,003	1,009,936	1,320,944
Increase Each Year		16,875	48,820	135,696	431,126	144,974	409,656	355,099	432,802	189,321	938,821

Engineering and Architecture



[*Reprinted from the School of Mines Quarterly.*]

REFRIGERATION AND ENGINEERING.

THE FREEZING PROCESS AS APPLIED AT IRON MOUNTAIN, MICH., IN SINKING A SHAFT THROUGH QUICKSAND.

By D. E. Moran.

(*Continued from December Issue, Page 333.*)

Excavation.—The progress of the excavation and timbering is shown by the accompanying diagram, which also shows the variations in temperature of the atmosphere, and of the brine returning from the ground. On the fifteenth day after starting the ice machine, excavation was begun with two gangs, working ten hours each. On the twenty-third day the supply of compressed air for the engine of the ice machine failed, and for sixty hours the ice machine was idle while a connection to an adjacent steam boiler was being made.

During this time excavation was suspended, and the temperature of the brine arose. Excavation and timbering were resumed on the twenty-eighth day, and continued without interruption until the seventy-fourth day, when cross-timbering was begun. This occupied our days, and but little excavation was done during this time.

At this time, and for ten days previously, a small amount of water found its way into the shaft, coming up through the unfrozen core. As the excavation progressed this increased in amount, so that a small pump was placed to keep the shaft dry. At first no sand came with the water, and no difficulty was occasioned, but on the ninety-third day the water increased in quantity, and sand began to come with it. Additional pumps were put in position, but as the flow of sand greatly increased, the shaft was temporarily abandoned, and filled with water up to the water level in the soil in order to equalize the pressure and prevent any further flow.

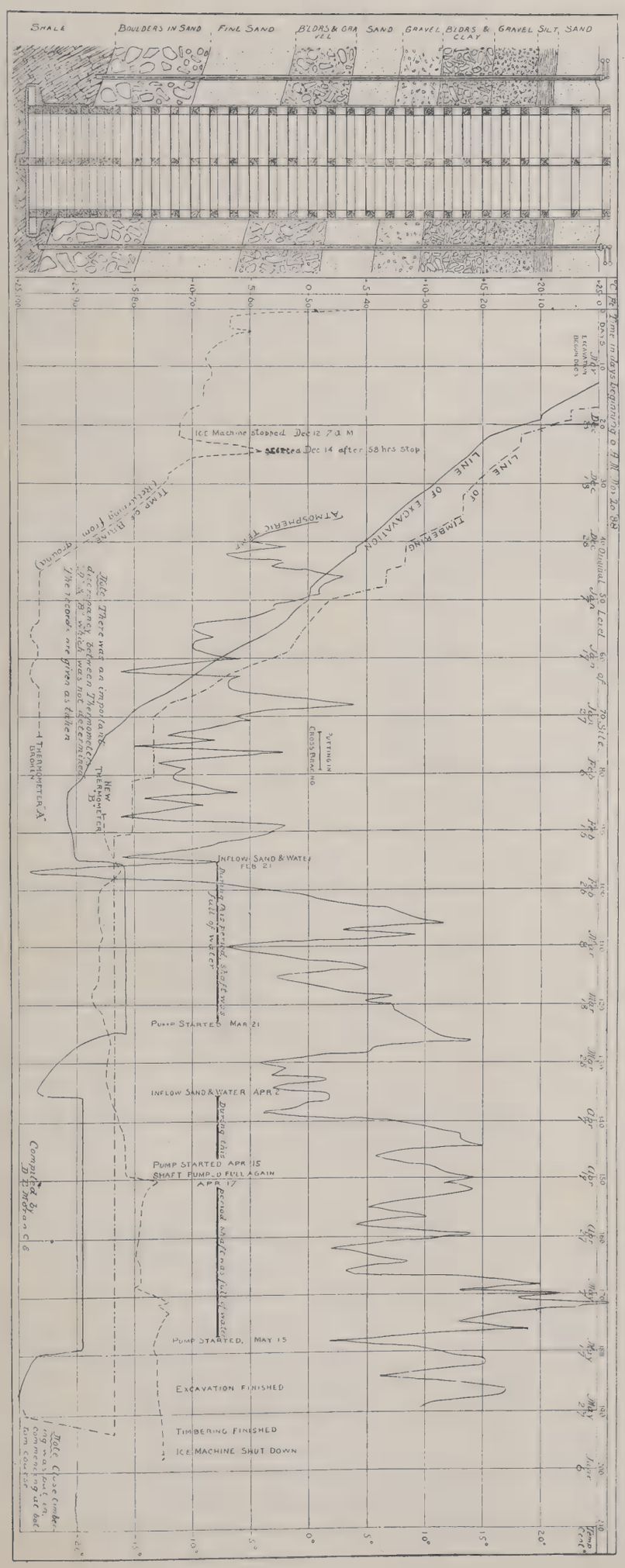
The reason (as was subsequently demonstrated) for the increase of the water and the flow of sand is this: As the excavation progressed, the unbalanced water pressure outside caused a small flow of water through seams in the ledge and into the unfrozen center of the shaft. This flow of comparatively warm water gradually heated up the partially frozen ledge and opened new passages, increasing the flow and ultimately thawing the base of the frozen wall, allowing the stream to flow directly in, carrying sand with it. At this point the increase of water was naturally very rapid, and the opening enlarged constantly, making a shut-down imperative.

In order to close this leak an additional freezing pipe was put in place inside of the shaft and near the location of the leak. The pipe was jetted down into position, and brine circulated through it continuously. On the 125th day the shaft was unwatered, and excavation begun again, only a small quantity of water coming in. The sand which had come in with the water was speedily removed, together with tons of ice which had formed on the walls of the shaft. Sinking was then resumed, and the flow of water being small, good progress was made. On the 135th day the pump was seven or eight feet in the rock, or nearly finished, when the flow of water increased very suddenly, driving the men up, stopping excavation and necessitating a second shut-down. The water came into the shaft at a point five feet above the bottom of the excavation where the base of the frozen sand wall joined the ledge. Before flooding the shaft a coil of pipes was suspended against the wall at this point, and pipe connections were carried from it to the refrigerating machine. The shaft was then again flooded.

After a period of freezing and trial pumping, the shaft was pumped out for the last time. The leak was effectually closed, and the excavation was completed without further difficulty.

Lining.—The timbering was put in position by the regular gang of miners after all the framing had been done on surface. The first and uppermost set of timbers was hung from heavy sticks which extended along two opposite sides of the shaft, and which were sufficiently long to get a solid bearing at each end six feet back from the edge of the excavation.

As the timbering progressed, each set was hung by links and screw bolts from the one immediately over it. Only the main timbers and the 4-inch lagging were put in position at first, the cross-timbers (or "dividers") not being put in until the timbering was nearly completed, and then in reversed order, beginning at the bottom and working up. The operation of putting in a set was as follows: The set having been framed, assembled and marked above ground, the first pieces sent down



were the two opposite ones, *b* and *b'*, Figs. 2 and 4, which were to be hung from the set above, and support in turn the other two pieces, *c* and *c'*, Figs. 2 and 4, by their halved ends. Pieces *b* and *b'* being in position, hanging loosely by the links and screw bolts, pieces *c* and *c'* were put in place without special care as to exact position. The four corner pieces ("studdles") came next, and then the nuts on the screw bolts were sufficiently tightened to steady the whole. All the pieces were then carefully adjusted, wedges being put in between the timbers and the frozen wall, and tightened or loosened until the set was square and in line. The nuts were then tightened finally, and the corner posts spiked.

The lagging was then sent down, sawed to proper lengths, and was put in place, commencing at the corner posts. The $1\frac{1}{2}$ " × $1\frac{1}{2}$" strip, spiked on outside of each timber, served to support each piece of lagging temporarily, while heavy wooden wedges were driven in the space between it and the frozen wall. It was considered desirable to fill this space as fully as possible, and where the material was especially fine, hay was also packed in with the idea that it would, when wet, swell and fill the cracks between the 4-inch lagging pièces, and prevent any sand from entering. The only difficulty was to get the last piece in position, and careful fitting was necessary to have it go in tight.

When the lagging was completed, the wedges driven in tightly all around made everything solid and immovable. Subsequently, however, 2-inch by 4-inch pieces were spiked to the lagging and to the timbers, and the joints between the pieces of lagging were waterproofed by strips of tar paper dipped in hot pitch and held in place by battens.

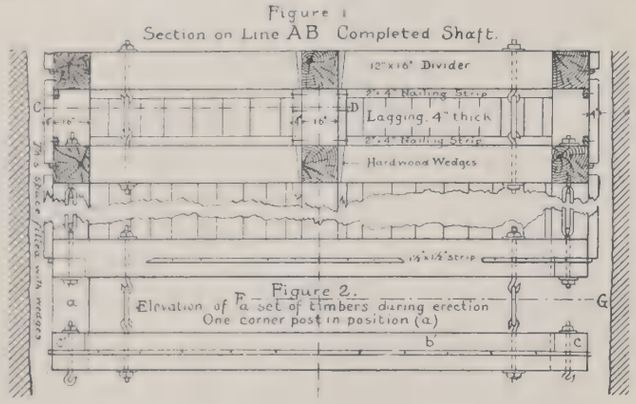
The details of the timbering are shown in Figs. 1 to 4, Plate 2. The timbering followed the excavation closely chiefly to save the trouble of scaffolding. The last fifteen feet of the shaft were close timbered from the bottom up, as will be more fully described hereafter.

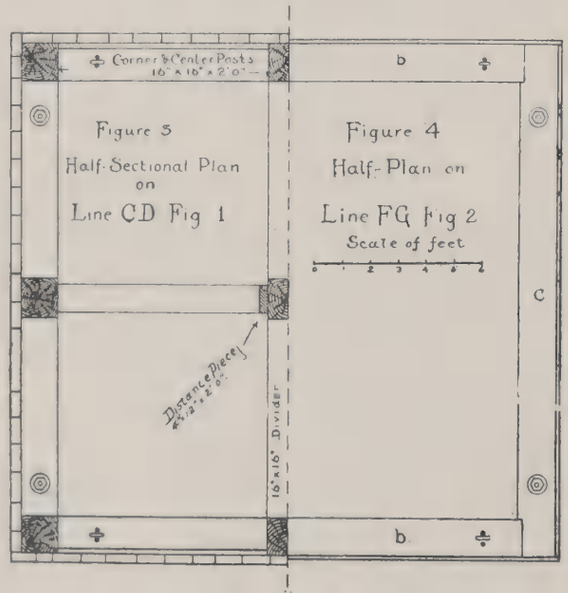
The solid, rock-like walls of the excavation enabled the work of lining the shaft to be done with extreme precision, so that the finished shaft was nowhere more than a quarter of an inch out of true or plumb, which is a degree of accuracy probably unattainable in sand shafts by any other method.

Making the Joint.—The completed excavation carried the shaft into the ledge from four to ten feet. It was necessary to make a tight connection between the ledge and the lining, and to arrange for the support of the timbering from the ledge. This latter was accomplished in the usual manner,

by running short drifts into the ledge at the center of each side, and putting in extra long and heavy cross-timbers. The joint was made by trenching in the bottom of the shaft for the bottom set of timbers, and carefully grouting the space between the timbers and the trench. To this bottom course of timbers the next course was fitted and spiked, and the space between it and the ledge filled with cement mortar. The gap between the lowest set of open timbers and the bottom of the shaft was, in this way, filled in with solid timbering. During this latter part of the work, the only water coming into the shaft came directly from the ledge through small crevices, but under such pressure as to make it squirt up three or four feet into the air. There was not a trace of sand, and not sufficient water to keep a No. 6

Figure 1
Section on Line AB Completed Shaft.





Cameron pump going, the leak which had caused trouble previously, having been completely frozen off.

When the timbering was completed, steam was turned into the shaft to thaw all ice on the timber, so as to permit the joints in the lining to be made tight with tarred paper, as before described. Finally, water was pumped in up to the level of the water in the soil, and the shaft left to thaw out. The purpose of filling the shaft with water was to equalize the pressure on the timbering during the thawing, which, it was thought, might bring sudden or unequal strains on the shaft.

At the completion of the work, in order to determine the extent of the freezing, a trial pit was sunk in the outer edge of the wall for twenty feet, and a steel rod was driven down considerably further. The wall had a batir, as before mentioned, but, assuming the measurement taken at the bottom of the pit to be an average value, the quantity of material frozen at that time was bounded by a cylindrical surface, fifty-four feet in diameter and about 100 feet in depth. This mass of frozen material took a long time to melt, notwithstanding efforts of the mining company to hasten the result. It was not until July 25, or fifty days after shutting down ice machine, that the ice wall gave way sufficiently to permit water to come into the shaft. The pressure of the sand on the shaft lining did not disturb the alignment at all, and the shaft is now being carried down into the rock by the mining company, with ordinary methods.

FARM ICE PACKING.

The method of building ice houses without requiring packing of sawdust, charcoal or other substances, merely by leaving dead air spaces, is considered very good for the requirements of creameries and farms. Dead air spaces have much power as non-conductors, and the method is a cheaper one. The system, however, must be carefully followed out for the best results, though a combination of the two systems is by far the best. The air chambers must be distinct, and must not admit a draft up or down, or around the ice. The air spaces must open into the upper portion of the house above the plate, that the cold air of evening may descend into them. This also allows air which may have become slightly heated, to rise above the ice without reaching it. Partitions must be tight. To receive the full benefit of the system, pains should be taken when the final layer of ice is packed and the covering with sawdust is in process, not to clog these air chambers.

At least two feet of space should be left for sawdust over the packed ice. Above the ice a ventilator should be placed, and left open to allow free ventilation above the ice, allowing the escape of heated air and ingress for the cool air which nights and storms may bring. With small quantities of ice, it is desirable, even with these air spaces, to leave a space of at least six inches between the inner ice house wall and the ice, which must be filled with tamped sawdust. Six-inch studding will do for the outside chamber, and four-inch for the inner chamber. It is heavy enough, and even four or three-inch lumber will do. To secure good drainage is easy in a side hill or on a very slight slope. If only a dead level is obtainable, the house should be well underpinned, and one or two courses of tiles laid to carry the water away from the house, if possible into gravel soil, care being taken to prevent a draft of air under the ice chamber.

An excellent plan in use under many ice houses is a cold storage room. A bank is most convenient for this arrangement, though by elevating the floor for ice four to six feet, a moderately good storage room can be secured with little extra cost. The one objection to this convenience under the ice chamber is, that it is likely to allow drafts of air up through the ice house unless great care is exercised. A tight, sloping floor should be made, and the drainage carried into a trough and away from the building in a pipe. Such a storage room is extremely useful in holding small fruits, vegetables, meats, etc., for market, and for preserving the family supplies. For foundation walls, nothing is better than concrete laid below frost. If they are of wood, they should be double or trible as for the ice house itself. Double doors and windows must be provided.

[*Written for* ICE AND REFRIGERATION.]

TO CALCULATE CAPACITY.

THEORETIC CAPACITY OF AN AMMONIA COMPRESSION REFRIGERATING MACHINE UNDER VARYING REQUIREMENTS AND CONDENSING TEMPERATURES.

BY EDWARD C. POST.



S THE capacity of a refrigerating machine, commercially speaking, is generally considered to perform the cooling equal to the melting of a certain quantity of ice under favorable conditions, we will now investigate what difference there will be in the cooling capacity of such a machine, under the most advantageous and most disadvantageous circumstances:

For convenience we will assume a *perfect* double-acting ammonia compressor, having a piston area of one square foot, a stroke of two feet, making fifty revolutions per minute, and absolutely no loss due to radiation, etc., etc. The specific heat of ammonia will not be taken into consideration. The ammonia table from M. De Volson Wood's work, "Thermodynamics," will be employed, and temperature measurements are by the Fahrenheit scale.

Our first investigation will be to determine how many heat units (B. T. U.) this machine will be capable of carrying off while reducing the temperature to +40°, with a condensing temperature of 60°.

From the table we find that one pound of vapor of ammonia at 40° occupies a space of 3.88 cubic feet ("back pressure" 73 pounds absolute, or 58.3 pounds gauge); our cylinder will take care of:

Weight of 1 cu. ft. am. Cu. ft. cyl. Rev. per m. Return stroke.

$$\frac{1}{3.88} \times 2 \times 50 \times 2$$

= 51.54 pounds of ammonia per minute,

which, after being condensed, has a temperature of 60°.

The latent heat of liquid ammonia at 60° is 517.93. The 51.54 pounds of ammonia will therefore absorb:

Latent heat. Lbs. am. Lbs. am. Difference of temp. of liq. and ret'r'ng vap. am.,

$$(517.93 \times 51.54) - (51.54 \times 20)$$

=25663.31 B. T. U. per minute.

As it requires 142 B. T. U. (latent heat) to melt one pound of ice, the equivalent in ice melting will be:

$$\frac{25663.31}{142} = 180.7 \text{ lbs. of ice per minute,}$$

or, for the day of twenty-four hours,

$$\frac{180.7 \times 60 \times 24}{2{,}000} = 145.1 \text{ tons.}$$

We will next consider the heat absorbing capacity of the machine for producing a temperature of +20°, with a condensing temperature of 80°.

From the table we find that one pound of vapor ammonia at 20° occupies a space of 5.82 cubic feet. Our compressor will therefore take care of:

$$\frac{1}{5.82} \times 2 \times 50 \times 2 = 34.36 \text{ lbs. per minute,}$$

which, after being condensed, has a temperature of 80°.

The latent heat of liquid ammonia at 80° is 504.66.

This gives the heat absorption of the 34.36 pounds:

$(34.36 \times 504.66) - (34.36 \times 55) = 15{,}459.31$ B. T. U. per minute; or,

$$\frac{15{,}459.31}{142 \times 2{,}000} \times 60 \times 24 = 78.33 \text{ tons of melting ice per day.}$$

Lastly, we will investigate the machine for producing a temperature of —25°, with a condensing temperature of 100°.

We find that one pound of gaseous ammonia at —25° occupies a space of 16.42 cubic feet.

$$\frac{1}{16.42} \times 2 \times 50 \times 2 = 15.83 \text{ lbs. of liquid ammonia at a temperature of 100°.}$$

The latent heat of ammonia at 100° being 491.5, gives:

$(491.5 \times 15.83) - (125 \times 15.83) = 5{,}801.7$ B. T. U. per minute; or,

$$\frac{5{,}801.7}{142 \times 2{,}000} \times 60 \times 24 = 29.4 \text{ tons of melting ice.}$$

[*Written for* ICE AND REFRIGERATION.]

AMMONIA.

ON SOME PHYSICAL, CHEMICAL AND PHYSIOLOGICAL PROPERTIES OF ANHYDROUS AMMONIA—THE DANGER OF EXPLOSIONS EXAGGERATED—THEIR PREVENTION.

BY J. E. SIEBEL,
Director of the Zymotechnic Institute, Chicago.

At present most refrigerating apparatuses are operated by anhydrous ammonia; and for this reason it is highly desirable that its general properties in connection with this object should be familiar to all who are interested in machinery of this kind. It is not supposed that anything particularly new and striking can be said upon this subject, yet there are some points in relation to the same which it appears are not quite generally understood. At ordinary temperatures and pressures anhydrous ammonia is a transparent gas of a most suffocating smell, but at temperatures below 30° F. it forms a transparent liquid, to which form it can also be brought at a higher temperature by applying sufficient pressure. The relations between temperature and pressure of anhydrous ammonia have been experimentally determined by Regnault; the results among others are set out in the following table on the properties of saturated ammonia, taken from Wood's "Thermodynamics," and compiled by him. These relations are also expressed by the formula, in which p represents pressure and T absolute temperature:

$$\log. p = 6.2495 - \frac{2196}{T}$$

In the table referred to, the first column shows the temperature by degrees F., while in the second column the temperature is registrated by degrees F. above the absolute zero of temperature. This point is 492° F. below the melting point of ice, which is to signify that temperature at which all substances are without expansive power or internal energy. In the same table are also shown the latent heats of volatilization or vaporization of liquid anhydrous ammonia at different temperatures, as also the volume and weight of saturated ammonia vapor under those conditions. The specific gravity of liquid ammonia varies with the temperature, and is 0.6364 at 32° F. according to d'Andreep, and for other temperatures may be found by the formula:

$$d = 0.6364 - 0.000777\ T$$

in which formula d represents the density and T the temperature.

The density of the gas, according to Regnault, is 0.596 at 32° F., and at 760 mm. pressure. The volumes cited in the subjoined table were calculated after the formula

$$v = \frac{h \cdot t}{6.4993 \cdot p}$$

in which p is the pressure in pounds, t the absolute temperature, h the latent heat of vaporization, and v the volume. The specific heat of liquefied ammonia is calculated by Wood to be 1.093 at a temperature of 34° F., and Strombeck experimentally determined the same to be 1.228 at 80° F. The specific heat of ammonia gas is 0.508 (Regnault).

PHYSICAL PROPERTIES OF SATURATED AMMONIA.

Temperature.		Pres'ure, Abs'lute.	Heat of Vap'riz't'n Thermal Units.	Volume of Vapor per lb. in Cu. Ft.	Volume of Liquid per lb. in Cu. Ft.	Weight of a Cu. Ft. of Vapor, Pounds.
Deg. F.	Abs'lute.	Lbs. per Sq. Inch.				
−40	420.66	10.69	579.67	24.38	.0234	.0411
−35	425.66	12.31	576.69	21.21	.0236	.0471
−30	430.66	14.13	573.69	18.67	.0237	.0535
−25	435.66	16.17	570.68	16.42	.0238	.0609
−20	440.66	18.45	567.67	14.48	.0240	.0690
−15	445.66	20.99	564.64	12.81	.0242	.0775
−10	450.66	23.77	561.61	11.36	.0243	.0880
− 5	455.66	27.57	558.56	9.89	.0244	.1011
0	460.66	30.37	555.5	9.14	.0246	.1094
+ 5	465.66	34.17	552.43	8.04	.0247	.1243
+10	470.66	38.55	549.35	7.20	.0249	.1381
+15	475.66	42.93	546.26	6.46	.0250	.1547
+20	480.66	47.95	543.15	5.82	.0252	.1721
+25	485.66	53.43	540.03	5.24	.0253	.1908
+30	490.66	59.41	536.92	4.73	.0254	.2111
+35	495.66	65.93	533.78	4.28	.0256	.2336
+40	500.66	73.00	530.63	3.88	.0257	.2577
+45	505.66	80.66	527.47	3.53	.0260	.2832
+50	510.66	88.96	524.30	3.21	.02601	.3115
+55	515.66	97.93	521.12	2.93	.02603	.3412
+60	520.66	107.60	517.93	2.67	.0265	.3745
+65	525.66	118.03	515.33	2.45	.0266	.4081
+70	530.66	129.21	511.52	2.24	.0268	.4664
+75	535.66	141.25	508.29	2.05	.0270	.4878
+80	540.66	154.11	504.66	1.89	.0272	.5291
+85	545.66	167.86	501.81	1.74	.0273	.5747
+90	550.66	182.8	498.11	1.61	.0274	.6211
+95	555.66	198.37	495.29	1.48	.0277	.6756
+100	560.66	215.14	491.50	1.36	.0279	.7353

Sometimes reference is made to the so-called explosive properties of anhydrous ammonia. Strictly speaking, however, anhydrous ammonia is not explosive; that is, not in the sense that gunpowder or nitroglycerine are explosive. There are some doubts even as to its inflammability or that of its vapor in atmospheric air; indeed, the text books proclaim that it cannot be ignited under those circumstances. While this may be true of absolutely pure ammoniacal gas, it is nevertheless a fact that vapor or gas as discharged by anhydrous ammonia in practical use about refrigerating machinery, possesses or has acquired a certain degree of inflammability, be it by reason of their admixture with fatty or oily inflammable bodies, or otherwise. Mixtures, therefore, of such ammoniacal vapor and air may become explosive in the same manner as mixtures of ammoniacal vapor and oxygen are known to be. Such mixtures, however, are not likely to occur under ordinary circumstances, as the presence of ammonia would be noticed by its smell long before its quantity in the air had become sufficiently prevailing to make it explosive. But extraordinary circumstances, such as the breaking or blowing off the head of a compressor, in which the ammonia is present in a heated condition, may cause, and we are informed have caused explosions, doubtless partly due to mixtures of ammonia (and probably also oily substances) with air formed under such circumstances and having been ignited by some gas light, which is frequently burning in a dark corner of engine rooms.

Such escapes of gas from a heated compressor are liable also to produce all the mechanical effects of an explosion without being ignited or mixed with air, in consequence of the great expansion of the liquid ammonia in assuming a gaseous condition. While lately these compressors are built of such material and of such strength as to leave little possibility for such calamities occurring, yet as a precautionary measure, the surrounding of gas lights by wire screens and the seclusion of engine rooms by self-closing wire screen doors might be advisable. This, while it would not lessen the mechanical effects, would nevertheless in a great measure prevent the ignition of any explosive gas mixture that might form under such circumstances. It is sometimes argued that anhydrous ammonia, being confined in drums under a great pressure (about seven atmospheres overpressure at 65° F.), presented a store of explosive material in itself, the same as a steam boiler overheated. Strictly speaking, such a condition does not take place with anhydrous ammonia, and at ordinary temperatures there is little danger of explosions of the drums, provided they are not quite full, and some space is left for expansion.

This, however, is a point of great importance and if not properly attended to drums are apt to burst (not explode) if the temperature is raised on them, as may easily happen in warm weather. In this case the ammonia behaves just like water confined in a vessel in which it has no room to expand, if it is exposed to an elevated temperature, or compressed by means of a pump, as is done, for instance, in boiler testing. In both cases the destruction of the vessel is due to the small degree of compressibility of the liquids in question. Manufacturers of anhydrous ammonia are sufficiently well aware of this condition of things, but operators of refrigerating machinery not conversant with the shipping of ammonia might make a fatal mistake, when they undertake to re-ship spent ammonia to the manufacturer for refining, as is sometimes done, in drums filled up to the brim. Any somewhat considerable increase in temperature is liable to burst such drums.

Such an occurrence, even if it did not produce any dangerous explosive effects, might, nevertheless, cause great danger to the safety of human life, inasmuch as ammoniacal gas, in the concentrated state, even if escaping at a non-explosive speed, might readily cause suffocation or less dangerous results; indeed, only a few seconds suffice to suffocate man or beast, if exposed to the vapors of anhydrous ammonia. Even ammoniacal gas, if diluted with a comparatively large amount of air, is dangerous to human life. Lehmann, who made experiments in this direction, found that an atmosphere containing .06 per cent of ammonia would cause the death of animals in an hour and a half, while an amount of ammonia .05 per cent caused irritation and may produce inflammatory conditions. He concludes, however, that human beings can accustom themselves to an atmosphere containing from .03 to .05 per cent of ammonia.

A Southern manufacturing paper reports sixteen ice plants erected, rebuilt or enlarged in the South during the last quarter of 1891. This construction is not up to former records but it is a healthy growth of the industry.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

·.· FEBRUARY, 1892 ·.·

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

PAYABLE IN ADVANCE.

Foreign Postage $1.00 in addition to Subscription Price.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1892, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

INDEX TO ADVERTISERS.

Ainsley, Cochran & Co.....146
Alaska Refrigerator Co.....90
Am. Ice Machine Co., of N. Y....147
Armstrong, Bro. & Co.....134
Armstrong Mfg. Co.....125
Arnold & Co.....133

Baragwanath, Wm. & Son.....125
Bartlett, Hayward & Co., Outside Back Cover.
Billington, Jas. H. & Co.....129
Bird, F. W. & Son.....132
Bird Paper Mfg. Co.....132
Black, A. W.....91
Blymyer Ice Machine Co.....148
Bodenstein, Henry.....126
Bodenstein, J. G. & Co.....127
Brandt, Randolph.....129
Briggs, John N.....126
Buffalo Refrig. Machine Co.....149
Buhring Water Purifying Co.....138

Callahan, W. P. & Co.....149
Canton Steel Roofing Co.....130
Cardell, James D., & Co.....141
Case Refrig. Machine Co.....144
Castle Ice Machinery Co.....144
Central Ice Co., The.....126
Chapman Valve Mfg. Co.....88
Clapp, B. P., Ammonia Co.....137
Cleveland Anhydr's Am. Works..136
Columbus Iron Works Co.....142
Conway, P. J. & Co.....91
Cook, A. D.....93
Cook, E. H., Co.....124
Craft Refrigerating Machine Co.145
Crane Co.....127
Curtis, J. Walton.....126

Dalzell, Jas. & Son.....134
Davis & Rankin B. & M. Co.....128
Dean Bros.....92
Deane Steam Pump Co.....93
De La Vergne Refrig. Mach. Co..154
Directory of Ice Factories, Ice Dealers & Cold Storage Houses.126
Dixon, Jos. Crucible Co.....124
Dodge, B. G.....133
Downie Bros. & Nevin.....89
Dunlevy Sheet Iron Works.....131

Edson, Jarvis B.....125
Electric Pipe Bending Co.....141
Epping, Carpenter & Co.....93
Excelsior Ice & Cold Storage Co..126

Farrell & Rempe.....142
Featherstone's Sons, John.....153
Forest City Packing Co.....129
Foster, Brown & Co.....136
Foster Pump Works.....93
Frick Co.....156, 157

Galigher, The F. L. Co.....127
Garlock Packing Co.....129
Georgia Ice Co.....126
Gerlach, Peter, & Co.....126
Gifford Bros.....126
Goodrich, B. F., Co.....134
Gordon Steam Pump Co.....88
Grand Rapids Refrig. Co., The...90
Graver, Wm.....128

Harrisburg Pipe Bend. Co., Ltd..140
Heerdegen & Schnee.....91
Heller, Hirsh & Co.....136
Hercules Iron Works.....87
Hendrick Mfg. Co., Ltd.....144
Hillyer, E. C. & Co.....150
Hilpert & Chandler.....91
Herf & Frerichs Chemical Co.....94
Hoppes Mfg. Co.....135

Illinois Metallic Pkg. Co.....129
Isbell-Porter Co.....143
I. & R. Binder.....124

Jackson Refrigerator Co.....90
Jewell, O. H., Filter Co.....138
Johnson, McCarthy & Johnson...145

Kahnweiler, David.....134
Kendall, Edward & Sons.....128
Kenly, D. F. & Co.....130
Keystone Chemical Co.....131
Krausch Co., The Theodore.....143
Krebs, H. J.....152
Kiechler Mfg. Co.....131

Laidlaw & Dunn Co., The.....92
Lansing Iron and Engine Works.128
Lawson, Enoch.....124
Loomis Imp. Filter Co.....138
Louisville Pipe Bending Co.....138

McCarthy & Son, James.....126
McCray Refrig. and C. S. Co.....90
Mackolite Plaster Board Co.....134
Maris Machine Co.....130
Maritzen, Aug.....125
Mason Regulator Co.....138
Merchant & Co.....136
Miami Valley Boiler Co.....128
Moyer, J. W.....130
Mustard, J. C.....152

National Am. Co., Outside Back Cover.
New Orleans Ice Mfg. Co.....126
N. Y. Coal Tar Chemical Co.....137
Northern Refrigerator Co.....90
Northwest C. S. and Ice Co.....126
Nubian Iron Enamel Co., The....123

Otto Gas Engine Works.....89

Peirce, A. H. Mfg. Co.....130
Pennsylvania Iron Works Co..145
Phosphor Bronze Sm'lt'g Co., Ltd130
Pictet Ice Works, The.....126
Pontifex Ice Machine Co., The...144
Pusey, Lea.....136

Queen City O. and W. Mfg. Co...124

Reading Iron Co.....139
Reeves, Paul S.....124
Reliance Gauge Co.....89
Rosengarten & Sons.....136

Samson Steam Forge Co.....139
Sauls Bros.....130
Seibel-Suessdorf C. & I. Mfg. Co..131
Severn & Caven.....137
Shipman Engine Co.....89
Smith & Vaile Co.....88
Southern Ice Machine Co.....151
St. John Cylinder Packing Co....129
Standard Ice Co.....126
Standard Paint Co.....132
Standard Thermometer Co....92, 135
Stilwell & Bierce Mfg. Co.....127
Stromberg, Allen & Co., Outside Back Cover.
Swanitz, A. W.....127

U. S. Mineral Wool Co.....132

Valley Pump Co.....92
Van Winkle Gin and Mach. Co...147
Vulcan Iron Works, The.....145

Wainwright Mfg. Co., of Mass...89
Wants, and For Sale, Etc.....123
Washington Market Co.....126
Watson, H. F., Co.....132
Weisel & Vilter Mfg. Co.....147
Weiskopf, A.....135
Westerlin & Campbell.....127
Western Ice Machine Co.....146
Western Mineral Wool Co.....132
Whitehill E. and P. I. Mach. Co..155
Wilson-Snyder Co.....158
Wingate & Mell.....131
Wolf, Otto C.....Inside Front Cover
Wolf, The Fred W. Co.....94
Wood, Wm. T., & Co.....126
Woolford, Geo.....124

York Mfg. Co., Inside of Back Cover

SEPTEMBER NUMBERS.

The publishers of ICE AND REFRIGERATION want to obtain a few dozen copies of the issue for September, 1891. All subscribers who will send us such copies will be compensated by the extension of their subscriptions by *two months*. Return by post, with the name of the sender endorsed on the wrapper.

BOUND VOLUMES.

The publishers of ICE AND REFRIGERATION have on hand a few complete bound sets of Vol. I of this paper, which will be sold at $5 per copy, bound in half Morocco, or $4 per volume, bound in half leather. Those of our readers who wish to bind their own copies may send them to this office, where they will be bound in half Morocco at $4 per volume, or $3 in half leather, the sender paying charges (express) both ways. The publishers can no longer furnish complete sets of back numbers, the editions for several months having been entirely exhausted, while the number of bound sets at above prices is limited to a few dozen copies, so that those who desire complete sets must order them at once. This is the only way that a complete file of the paper can ever be obtained.

SOUTHERN ICE EXCHANGE.

The annual meeting of the Southern Ice Exchange will be held at Birmingham, Ala., February 25, 1892. The answers to the circular to members, asking for information relating to the trade (see official notice, Vol. I, p. 148, ICE AND REFRIGERATION), will be compiled and read at that meeting. At the last (1891) meeting, the following gentlemen were appointed to read papers on topics assigned, which will no doubt be an interesting feature of the proceedings of the Exchange: Mr. Biese, on "Distillation"; Mr. Hard, on "Selling Ice"; Mr. Howe, on "Management of Factories"; Mr. Meadows, on "Refrigeration"; Mr. Benjamin, on "Bookkeeping and Accounts"; Mr. Cole, on "Ticket and Recording System"; Messrs. Stell and Kern, on "Impurities in Ammonia"; Mr. Rushton, on "General Troubles of the Trade."

A BUFFALO paper in noticing a work by Dr. Ball, entitled "The Cause of an Ice Age," says that Dr. Ball (who is astronomer royal of Ireland) thinks the "ice age was due to astronomical perturbations involving a change in the inclination of the pole to the ecliptic." Would it not be simpler to adopt the theory of Dr. Tyndall, and say that in the early history of our planet the globe was hotter than now, or the sun's rays more powerful, inducing a tremendous evaporation at the equator, which condensed at the poles, causing the enormous volumes of ice characteristic of the ice age? There is no difficulty in explaining the movement of these masses of ice which have left their mark on the rock formations of the globe, as well as in the configuration of the surface, since Mr. Tyndall, by experiments at the Alpine glaciers, proved conclusively that ice—a glacier—moves, or "flows," exactly as a river of water flows, though, of course, with less speed.

A RARE opportunity for the right man is offered in our "Want and For Sale" column: Item, "Ice Machine Supply Business for Sale." which see.

ANSWERS TO CORRESPONDENTS.

COOLING AMMONIA WITH AMMONIA AFTER IT HAS LEFT THE BRINE TANK—TO CALCULATE THE FORCE NECESSARY TO COMPRESS A GAS—DISCOLORATION OF DISTILLED WATER IN ICE MAKING, ETC.

This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest. Correspondents, especially when asking questions of a technical character, cannot be too explicit in giving details. In stating temperatures, the kind of scale should be indicated; and in giving pressures it is well to state if pressure above that of the atmospheric pressure or above vacuum is meant. Write on one side of the sheet only.—ED.

To the Editor: We would like to know, if after the ammonia has left the compressor, it would be as well to cool it with the ammonia after it had done its work in the brine tank and before it goes to the compressor, as I must keep my brine down to zero. I have a cold water jacket around the cylinder, and the water of the well is 54° F. The volume of my compressor is 6×9; the number of strokes is fifty per minute; the temperature of ingoing brine, 4° above zero F.; that of outgoing brine, zero F. Dimensions of brine tank: 12 feet long, 30 inches wide, 30 inches deep. I have a double-acting compressor, and thought that by cooling ammonia with ammonia gas it would expand much cooler, as I have no further use for the gas after it has done its work in the salt brine tank, except to compress it. After the gas is compressed, I work at about 150 pounds per square inch. The object of the machine is to freeze cream and keep it frozen; quantity about 200 or 300 quarts per day. Will you kindly inform me also what would be the best back pressure to work at?

A. D.

ANSWER.—To commence at the end: The back pressure to work at is governed by the temperature of your brine. If you must have your outgoing brine zero, the back pressure will be in accordance with that condition. The only question would be, whether you could not get along with brine of a higher temperature, say by circulating it quicker, as in that case you could work with a higher back pressure, which works more economically. Again, the back pressure being, as it is in your case, a given quantity, you cannot increase the total refrigerating effect of expanding ammonia in the brine tank by using the ammonia before it enters the compressor to cool the liquid ammonia before it enters the refrigerator, or coils in brine tank. To increase the efficiency of your machine, the compressor might be worked at a higher speed, fifty strokes (if you do not mean revolutions instead) being a very slow one, and even if revolutions are meant it might be increased somewhat. You can also increase the efficiency by using a larger supply of cooling water.

To the above question we have received also the following answers, from esteemed correspondents:

(1.) To get the greatest possible work out of your machine, run it with as high a back pressure as possible, without carrying liquid ammonia into the cylinder. This condition of things is indicated by the frost on the return pipe running nearly but not quite up to the compressor. (2) Inject the liquid ammonia into the coils at as low a temperature as possible. If it comes from the condenser much above the temperature of your well water use the latter to cool your liquid ammonia. (3) No advantage would be gained by using the cold which your machine has produced to do cooling on any part of the apparatus itself. If your brine is at 0° you ought to be able to run with a back pressure of from nine to twelve, provided you have sufficient coil and good circulation.

GEO. RICHMOND.

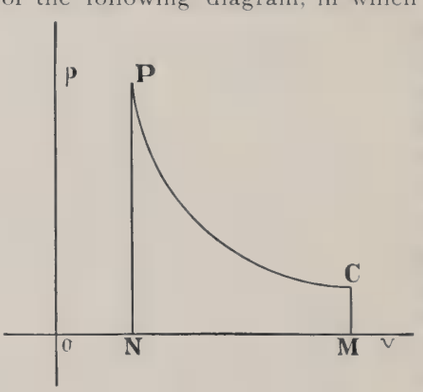
By cooling the ammonia as you suggest, before expansion in the evaporating coils, you would of course gain in the expansive power of the ammonia and the consequent increase in heat absorbing gas; *i. e.*, one cubic inch of the liquid will expand to 1,000 cubic inches of the gas, and it has the capacity to absorb from surrounding objects as much heat as is given out under compression. The exact resultant cannot be estimated in your case without carefully noting the compression area you have.

F. L. GALIGHER.

To the Editor: Can you give us a formula by which we can calculate the amount of force necessary to compress a gas, for instance, air, say 100 times?

D. H. C.

ANSWER.—If your question refers to the pressure necessary to retain air or gas so compressed, it would be equivalent to sustaining 100 atmospheres (if the original gas was a perfect gas and under ordinary atmospheric pressure), that is, p. p. 1,500 pounds per square inch. If your question refers to the amount of labor necessary to accomplish such compression, it is deficient in not stating the original amount and pressure of gas. If we assume that the compression takes place at a constant temperature during compression, the labor necessary for this purpose may be derived by a consideration of the following diagram, in which $O\ V$ is the axis of volumes, and $o\ p$ the axis of pressures. Then, if $O\ M$ represents the original volume of the gas, and $O\ N$ the volume of the gas after compression, and $M\ C$ and $M\ P$ the respective pressures, all measured by the same unit, representing cubic feet, in the case of volumes, and pressures in pounds per square feet, the area $N\ P\ C\ N$, bounded by these quantities, and the hyperbolic curve $P\ C$, indicating the different pressures, give the amount of labor necessary for compression in foot pounds. Numerically, the amount of labor, L, can be found after the following formula:



$$L = P\ N \times O\ N\ log.\ nat.\frac{O\ M}{O\ N}$$

Or also

$$L = P\ N \times O\ N \times 2.3026\ log.\ \frac{O\ M}{O\ N}$$

In your case, $\frac{O\ M}{O\ N}$ is equal to 100; but in order to complete the calculation, you must insert the original volume $O\ N$ and pressure. The final pressure $P\ N$ is then equal to the original pressure multiplied by $\frac{O\ M}{O\ N}$.

To the Editor: I am engineer of an absorption ice plant. The first part of the season I had no difficulty in keeping my distilled water bright and clear; but later on, say the last third of the season, it would get red in spite of all I could do. I find other plants have the same trouble. Is it alkali in the water? For my trouble commenced after the dry season set in, when the water begins to get low and scarce. What puzzles me most is that the distilled water will be red for three days or a week, then clear up for a day or two, then turn red. Blowing out the pipes through which the water runs does not seem to do any good, when I get disgusted and don't do anything. Then it does just the same thing—first good and then bad. Would it

make any difference in the capacity of the machine should the brine in the freezing tank become weak through overflowing the ice molds with distilled water? If you can enlighten me on these points you will much oblige W. W.

ANSWER.—It is very difficult to give a satisfactory opinion of the nature and cause of your trouble without subjecting the water to chemical examination. Is it not a fact, perhaps, that your plant works with interruptions, staying idle for short periods and allowing air and water to alternately and at different temperatures affect the inner surface of the pipes? In such a case the phenomenon might be explained by the formation of rust during such idle periods, which, after it has gained a certain thickness, is loosened and blown or washed out by the effects of renewed distillation, the action of moving live steam and water. This is about the only way which we can find to explain the freaky action you complain of. The overflowing of ice molds into the brine tank will not lessen the capacity of the machine, nor otherwise interfere with its working, as long as the brine keeps strong enough to be prevented from freezing at your working temperature. For this you must look out.

To the Editor: Which is the proper way of spelling: "Catsup" or "Catchup"? P. S.

ANSWER.—Webster gives both ways, without discriminating in favor of either; and thinks that the word may be of East India origin. In case its English coinage were admitted, the latter way of spelling would be the most indicative of its property of stimulating the digestive activity of the stomach.

To the Editor: Can stale beer, or, for that matter, any other liquid, be refrigerated by charging the same with liquid carbonic acid? or will gaseous carbonic acid do the same? TH. S.

ANSWER.—If the liquid be charged with liquid carbonic acid to saturation only, there will be no considerable reduction in temperature, since the carbonic acid, although disseminated through the liquid, retains its liquid state, as it were, and, therefore, does not absorb any heat due to volatilization. If, however, more liquid carbonic acid than is necessary for saturation be passed into the liquid, the surplus, while volatilizing from the top of the liquid, would cool the same correspondingly. On the other hand, the liquid would become correspondingly warmer if charged with gaseous carbonic acid, the latter discharging heat during the process of becoming liquefied.

To the Editor: In a former issue of your journal I have seen an article on what was called "The Ice Machine of the Future." Do you know if any steps are being taken to realize this scheme, or are there any hopes for its ever being realized? F. P. C.

ANSWER.—As the author of that article stated therein, it was never intended that a machine of this kind should be built, but that it was meant for a theoretical diversion, tending to draw attention in a graphic manner to the great amount of energy being carried away by the water in the condenser, and, if possible, to suggest possible uses for this quantity. As to the possible theoretical realization of such a scheme the author says that it depends on the question as to whether the law of eutropy applies to electrical force and chemical affinity, the same as it does to heat, a question which is not fully decided, however. He says, moreover, the question is not one of creating or preserving energy, as some critics seem to have supposed.

——The ice of the Truckee, Cal., fields is said to be the finest ever known. The harvest began early in the month.

IN THE calculation made on pages 93–5, of Vol. I of ICE AND REFRIGERATION, in an article discussing the "Economy of Refrigeration," that item including in the capacity for refrigeration the work done by the expanding ammonia on the compressor ought to be deducted from this quantity. This does not change the results and conclusions drawn from these calculations, nevertheless it is desirable to make this correction in order to prevent any misunderstanding on this score.

MINOR LEGAL MATTERS.

——Locket & Lacounim, ice dealers of Louisville, Ky., have failed. Liabilities, $25,000.

——The Union Fuel & Ice Co., Portland, Ore., has made an assignment to Chas. J. Schnabel.

——The Independent Ice Co., of Denver, January 9, brought suit against about 150 consumers in a justice court. The reporter laconically says: "There was a picnic."

——The Ligonier Valley Ice Co., Pittsburgh, Pa., has applied for a surrender of its charter, to avoid paying corporation taxes. The business will be continued by the members of the company.

——The Co-operative Ice Co., of Machias, N. Y., will wind up its business and be dissolved. There is a mortgage of $25,000 on its property, and an offer has been made for the plant as a whole.

——The C., B. & Q. R. R. Co. has secured an injunction preventing ice cutters from harvesting ice in the Mississippi river at Quincy, on the Illinois side, opposite the river frontage of the company.

——The Western Ice Machine Co., of Chicago, entered suit in chancery January 2 against the Chattanooga Brewing Co., Chattanooga, Tenn., for $5,513,45, balance due on the $30,000 ice machine made for the brewing company.

——The Co-operative Ice Co., of Buffalo, N. Y., organized in 1889, with a capital of $40,000, has wound up its affairs and retired from business, all its property having been sold at auction. The business has been unprofitable since the ice famine of 1890 began.

——John D. Chamberlain, of Rochester, N. Y., has begun an action against the Lockport Brewing Co., Lockport, N. Y., for $6,500, the balance due for the construction of an ice machine. The company defends on the ground that the machine was not put up according to contract.

——Application has been made by E. W. Tarbot, a stockholder and formerly secretary, of the Crystal Ice Co., Spokane, Wash., for a receiver for that corporation. He charges fraud in the management. The company is capitalized at $30,000, there being 300 shares of stock, of which Talbot alleges he purchased 120 shares at par.

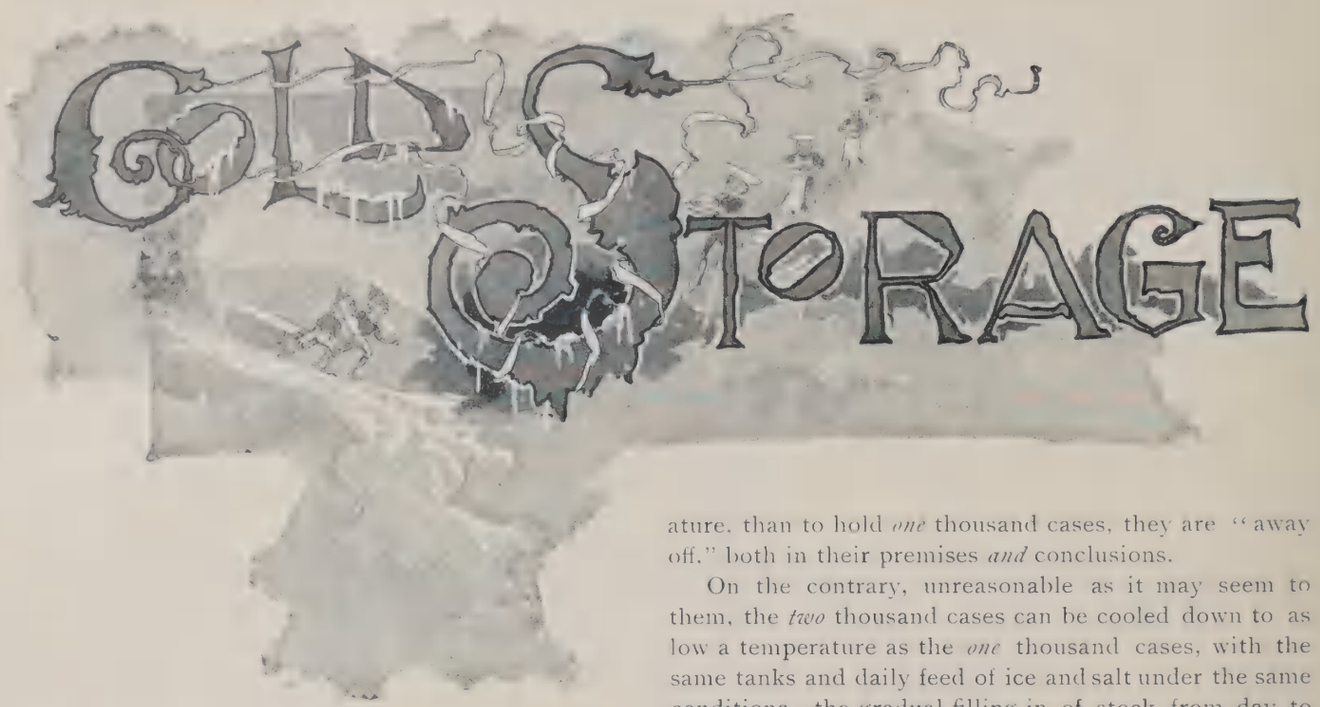
——The case of H. R. Riendeau *v.* R. Bullock *et al.* has been decided in favor of the plaintiff by Referee Tierney, of Plattsburgh, N. Y., and a judgment for $4,646.82 and $311 interest, besides costs, rendered. The suit was brought to recover for ice stored by the plaintiff, which the defendants failed to remove, according to contract.

——The accounts of George V. Brower as receiver of the Ridgewood Ice Co., New York, were filed January 9. The receiver says that property valued at $411,872.10 came into his hands, and that he has paid out in conducting the business $376,810.03, leaving a balance, with the value of ice, etc., on hand, of $52,476.20. Of the amount spent $50,000 was for improving the business.

——The referee's report in the suit of John Harvey *v.* The Knickerbocker Ice Co. was filed at Philadelphia, December 27. On August 12, 1889, while Harvey was driving a wagon across the Chestnut street bridge, the team was run into by a loaded ice cart belonging to the defendant company, and Mr. Harvey was thrown out and seriously injured. The referee finds that the Knickerbocker Ice Co. was responsible for the accident, and awards Mr. Harvey $1,000 damages.

——The case of Wing and Prentiss *v.* The Three Star Ice Co. was heard at La Crosse, Wis., January 2. The case was a claim for $12,000 damages. The defendants took ice from the waters of French lake, owned by the plaintiffs, who attempted to show the value of the ice taken. The defense sought to show that French lake was subject to laws governing lakes and ponds, and not a running stream. The court was of the opinion that the plaintiffs were the owners of the lake, and, therefore, had a right to claim damages, but the damages should be measured by the actual value of the property taken, which was small, as the defendants took but a small portion of the ice in the lake, and he placed the nominal damages at $25.

——The branch of the National Soldiers' Home at Leavenworth, Kan., got a full stock of 8-inch ice for the home on Lake Jeannette.



[*Written for* ICE AND REFRIGERATION.]

ICE v. MECHANICAL REFRIGERATION.

THE TWO METHODS DISCUSSED—A CRITICISM OF THE CRITICS—THE THEORY AND PRACTICE OF COOLING COLD STORAGE ROOMS WITH ICE.

BY D. B. BEEMER.

In December number of this magazine, the Hercules people,—in discussing the question raised by me, as to the power of an artificial cold plant to dry the air in an insulated room, *after* the ice formed on the cooling pipes by condensation of the moisture in the room had become so thick that the cold air in the pipes lost power to condense on its surface further, and it had become *wet and dripping*, instead of being *dry and frosty*,—explained that they overcame this difficulty by providing duplicate coils, or "sets," of cooling pipes in each room, so that they were able to divert the cold current from one to the other, as occasion required, and allow the accumulation of ice referred to to melt and dislodge from the pipes so incumbered, and expose their bare surfaces again.

This method, of course, is reasonable in theory, and should be successful in practice,—making the air in the cold rooms dry; but the apparent necessity that existed, and which led the Hercules people to adopt the plan, shows that the ground I took—that a simple set of pipes in a room could not dry the air in said room beyond a certain time indicated by the thawing surface of the ice on the pipes—was well taken, and that unless the plan adopted by the Hercules people is available and used by the manufacturers of other systems and plants for production of artificial cold, they must of necessity be as unreliable in this respect, as the "plants" run by natural ice, in either the "overhead" or "side tank" systems.

But when the Hercules people farther lay down the principle that "ice has but a limited amount of efficiency, beyond which it is incapable of working," and then, by way of illustration, state as a fact, that a room cooled by ice, and having a storage capacity of *two* thousand cases of eggs, *requires more ice in proportion* (inferentially double the quantity) to hold these at a given temperature, than to hold *one* thousand cases, they are "away off," both in their premises *and* conclusions.

On the contrary, unreasonable as it may seem to them, the *two* thousand cases can be cooled down to as low a temperature as the *one* thousand cases, with the same tanks and daily feed of ice and salt under the same conditions—the gradual filling in of stock from day to day, in the ordinary course of business,—and when the room is at last full, and the contents chilled down to 32° to 36° F., it will take less ice and salt to hold them there—the *two* thousand cases—than it will to hold *one* thousand cases at same temperature. The reason for this lies in the fact, that when the room is full of eggs, chilled down to near freezing point, *the mass refrigerates itself*, in great part, and the tanks of ice only serve the purpose of regulating the temperature by and through their reserve power, and holding it steady.

The prime mistake, apparently, of the Hercules people is the confounding of the two systems of natural ice cold storage, or refrigerating—the so-called "overhead," and the "*tank* system"—assuming them to be practically the same in their workings and effects, when, as a matter of fact, they *are radically different* in both, and also in principle. The cold from the overhead system is produced simply by allowing the air about the mass of ice stored in bulk to fall by gravitation to the rooms below, and the lowest degree of cold thus obtainable is limited to 36° to 37° F. The tank system, on the contrary, produces cold by radiation, through and from the metal surfaces of the tanks, in a manner similar to that in which heat is radiated from the metal surface of a stove. In fact, it is the same system—*reversed*. The tank is the *cold stove*, radiating cold from its surface, instead of heat. The ice is the fuel and the salt consumes it and liberates the cold, similarly to fire consuming fuel and liberating heat from a stove. The lowest degree of cold obtainable through this system depends, *not* upon the quantity of ice in the tanks, as measured by tons or cubic feet, but upon the number of *square feet of radiating surface* presented by the tanks in the room *and* the proportion of salt, mixed with the fine ice, fed into the tanks while keeping them full. Therefore, a tank occupying one side of such a room from floor to ceiling, while only a foot wide on the top, and running to a wedge shape at the bottom, is capable, with such a light feed of ice as it is capable of containing, and, properly salted, of producing as much and as intense cold in a given time, as a tank several times as "thick through" and of uniform

"thickness" all the way down to the floor, and thus capable of holding many times as much ice as the wedge-shaped narrow one—the *only* advantage it would possess over the other being a few extra square feet of condensing surface at the widened ends.

With ice in a tank, it is the same as with wood or coal in a stove—the more rapid and free the combustion the greater the degree of cold and heat radiated from the metal surfaces of the tank and stove. The combustion of the ice is regulated by the amount of salt mixed with it; and this in turn is regulated by *the degree of cold desired.* A room properly fitted up with these narrow tanks can readily be chilled down to near zero, and such goods as poultry and game, once frozen up, can readily be held so in it, with a feed of ice and salt but little heavier than that required to hold eggs at 36° F., it being a case of *self-refrigeration* again, as before described.

So, too, with their theory concerning condensing moisture out of a room—that it requires twice as much apparatus, or power, to dry a room with 2,000 cases of eggs in it than if but 1,000 cases were in it. As a matter of fact, after eggs are once chilled down, very little moisture emanates from them. At a temperature of 35° F., they practically *cease* to throw off caloric to condense on the cold surfaces of the room. A trifle of moisture is thrown off by evaporation through the pores of the shell, and *but* a trifle. Practically, after the eggs are chilled down, the moisture liberated in the room has its source in the tanks solely, and can, therefore, be as readily taken care of by the condensing apparatus, or by the condensing surfaces of the tanks themselves, in the case of 2,000 cases of eggs, as in the case of 1,000, since the tanks and quantity of ice used will be identically the same in both cases.

They speak, too, of the bad effect of "water dripping upon the floors of rooms from wet surfaces of the tanks." Do they not know that the tanks always have metal catch-basins to receive and convey such water off through waste pipes to outside drains?

Mr. Gay's suggestion about providing an ante-room in front of the main entrance to a cold room to prevent access of outside air when the door is opened for any purpose, is sensible, and its adoption would prevent a great deal of moisture from accumulating in the room through the condensation upon the cold surfaces of the warm outside air which ordinarily finds its way in upon the opening of the doors, this being the usual way in which moisture forms in a room, under such circumstances, rather than from the admission of "moisture-laden air," as Mr. Gay suggests. This idea of his is in keeping with my suggestion in a former article—that, when filling rooms with stock, it should be done through hatchways in the floor above, while the side doors should be kept hermetically sealed till cold weather sets in, and the stock is wanted out.

Mr. Kilbourn's remarks in the same article, about "saturated air," are very interesting, as showing how this moisture is liberated, or set free, in regular gradations *as the temperature is lowered;* but when he states that 1.97 grammes of moisture remain in a cubic foot of saturated air after it is cooled down to 30° F., one is led to ask, How can this be? Why is it not *all* frozen out at 32°? If no metal surfaces are contemplated in the calculation, would not the moisture, at 30°, still be precipitated in the form of frost crystals upon boards or other surfaces in the room? He says, farther, that "air cannot be cooled by ice alone, below 32° F." Did he ever know of its being cooled as low as that by ice alone—that is, the air in an insulated storage room?

COLD STORAGE FOR YOUNG TREES.

C. A. Mills, writing to a Southern paper on this subject, proposes a new phase of the usefulness of cold storage, which is as interesting as it is novel. He says:

"Of late we have seen articles in various scientific publications speaking in high terms of a newly discovered plan of keeping young nursery trees in cold storage for a time prior to planting out in the open ground, or until the land outside has fairly warmed up. It appears to have been a Berlin discovery, and is thought to be one that will prove of great advantage to horticulture.

"The principle is undoubtedly a good one, especially where applied in warm countries. If we plant the tree out some time during the winter, in a warm country, there are repeated but abortive efforts on its part to start into growth, which tend largely to exhaust its vitality ere the proper growing season has arrived, but under cold storage no such efforts are made. The young tree lies entirely dormant until the suitable conditions for its rapid and continuous growth have arrived, when, having been set in the open ground, it at once brings all its growing energy into play and starts off with a regular boom, as it were. The thing works on precisely the same principle as governs in case of the cutting to be grown as such, or the scion to be employed in grafting—we take these from the parent tree and bury them in the ground ere any growth has started, to hold them in proper condition for use until the period for their regular growth has arrived.

"Of course no sensible man will confuse this new cold storage of nursery stock with the old winter storage as practiced by nursery men at the North. The latter consists in simply taking up and storing the young trees in a house or cellar where the nursery man can get at and handle them through winter, a thing he could not do were they outside in a soil deeply frozen and as hard as a rock. The sole object of cold storage is to hold back premature and irregular growth, which of course would render the young trees more or less sappy and tender. A blizzard following this sappy condition is liable to injure the young tree more or less, even though it has not yet been removed from the nursery bed—if already transplanted the effect could not be otherwise than decidedly against it. The newly transplanted tree is weak and sick in a measure. It has no extra vitality to expend in combating unfavorable effects; therefore, a premature growth to be followed by killing frost, while it might not destroy the tree outright, would certainly work upon it a very serious injury. Cold storage effectually guards the young tree against any such trouble, for it maintains a complete suspension of growth up to that time in the season when there is no danger whatever that the growth, once started, will not go directly along without interruption."

THE "Want and For Sale" column this month, as usual, contains some good things. It is valuable to all our readers, and should be carefully read every month, and use it as their needs suggest.

NEW COLD STORAGE PLANTS.

The record of new plants, improvements, etc., for this month is not large, but it shows continued activity in this line of construction. The most important work of the month is the movement to establish pipe line plants at Seattle, Wash., and at Philadelphia, Pa., both noted in detail in this issue.

FLORIDA.

Jacksonville.—Olmsted & Stokes, makers of fruit juice ciders and vinegars, have a large cooling room for the storage of their products.

ILLINOIS.

McHenry.—John I. Story, of the Riverside house, is building a cooler in the rear of his hotel, to be cooled by natural ice. It will be 16×18×16 feet.

IOWA.

Waterloo.—The Herrick Refrigerator and Cold Storage Co. has been incorporated; capital, $85,000. The company will manufacture refrigerators and cold storage rooms.

MICHIGAN.

Grand Blanc.—Grant Cheeney is building a large meat cooler near his meat market.

MISSOURI.

St. Louis.—Fred Kayser has purchased a 1-ton refrigerating machine from Ainslie, Cochran & Co.

NEBRASKA.

Omaha.—The Pottawattamie County Fruit Growers' and Gardeners' Association recently held a special meeting at Omaha to form an organization for the purpose of establishing a cold storage warehouse. An establishment of this kind is a necessity to a region where so much fruit is grown as in Pottawattamie county, and the fruit growers have come to the conclusion that the time has come for an organized effort to be made. Negotiations are already pending for the renting of an old packing house during the coming season as a place in which to make the experiment. If the scheme is carried out, as it now seems likely to be, a large storehouse will be built in Omaha.

NEW JERSEY.

Plainfield.—The Plainfield Ice and Cold Storage Co. has been incorporated; capital, $50,000. The chief stockholder in the enterprise is ex-Senator Aaron D. Thompson, a wealthy stock raiser. The erection of an ice manufactory and cold storage warehouse will be immediately begun. The site chosen is along the Jersey Central railway, near Netherwood. Ice machines will be built and put in operation for the supplying of wholesale and retail dealers, and in addition there will be chambers where meats, fruits and vegetables can be preserved in large quantities for the markets.

NEW YORK.

Albany.—The Albany Cold Storage and Warehouse Co. has been incorporated by Thos. Austin, S. D. B. Solden, John D. Capron, Edward C. Smith, John D. McKinlay; capital, $10,000. The company proposes to do a general cold storage business, issuing warehouse receipts for merchandise, etc.

PENNSYLVANIA.

Emlenton.—The Case Refrigerating Machine Co., of Buffalo, (not the Craft Refrigerating Machine Co., as stated in our last issue) have closed a contract with the Emlenton Producers' Oil Co., of Emlenton, Pa., for a 20-ton refrigerating machine, to be used in their paraffine works.

Lancaster.—A cold storage and ice making plant is to be erected here, the machinery to be furnished by the Automatic Refrigerating Co., of this city.

Reading—The Reading Cold Storage Co. have purchased two 35-ton refrigerating machines of the De La Vergne Company.

TEXAS.

San Antonio—The San Antonio Cold Storage & Manufacturing Co., lately incorporated, will put in a 20 or 25-ton refrigerating plant.

WASHINGTON.

Seattle—The *Post* says: "H. J. Claussen has bought a controlling interest in the Seattle Automatic Refrigerating Co., and will become president of the concern. It is his plan to put a good deal of money into the company, extend the plant and warehouse very considerably and go into the manufacture of ice. The Pacific Freezing and Cooling Co., having obtained for Washington and Oregon the patent rights of the Consolidated Refrigerating Co. of New York, erected the present plant. The Pacific Co. acts only as a construction company, and has sold the plant for operation to the Seattle Automatic. The Pacific Co. will now proceed to erect similar plants in other places in Washington and Oregon." The contract for the erection of the additional building for the company at Seattle has been awarded. The building will be two stories high, with ground dimensions of 170×60 feet. The company was organized to carry on a general cold storage business, and also to distribute cold to those who need it in their business. They expect to lay one mile of pipe this coming spring, distributing cold on the plan in practice at St. Louis and Denver.

WISCONSIN.

Sheboygan—The Sheboygan Cold Storage Co. have begun work on their building, which will be located on the river front, with railway side track into the building. The building will cost $10,000.

A St. Paul paper says that, fresh eggs being scarce, "the cold storage firms are resorting to schemes to palm off storage eggs as fresh. They are said to ship quantities of storage eggs to some small town where there are no storage facilities, and then ship them in small lots to the city dealers under fictitious names as fresh eggs." This is quite a heinous offense, surely, to palm off a "cooler" egg, that smells, tastes and beats up like a fresh egg, on an unsuspecting and unsophisticated female, who can't tell it from a "fresh" egg, unless it is labeled "cooler"! Of course, all "cooler" eggs are not fresh and sweet after months of storage, for there is "cold storage" and "cold storage," some very good and some bad, or, at least, imperfect; but when eggs are properly stored in the right kind of cold storage, there ought to be no appreciable depreciation of their quality as a wholesome and toothsome food, if only the skeptical public are taught to deem them such.

Two clever young men at Pittsburgh have put a flea in the ears of egg buyers in that city and a pot of money in their own pockets by a shrewd use of refrigeration which is "easy enough" in many places, but does not seem to have occurred to Pittsburghers generally. Last June these two young men began to buy the output of the humble hen of commerce in the surrounding country. They made no noise, but bought all offered. As the eggs were brought to Pittsburgh they were placed in cold storage warehouses, and now they are coming out—not fast enough to glut the market, however. The "boys" secured about 230,000 dozen, at an average price of twelve cents, and are now unloading at twenty-five and thirty cents.

The authorities of St. Louis recently passed an ordinance prohibiting farmers from occupying the Third street market square later than 6 o'clock A. M. The farmers now propose to quit St. Louis and under the leadership of Mayor M. M. Stephens propose to erect a wholesale depot at East St. Louis to which the truck farmers who raise early vegetables on the rich bottom lands of St. Clair county may bring their products, where they will be loaded into refrigerator cars and shipped to Chicago. Mr. Stephens was recently in Chicago to perfect arrangements for handling the product in the latter city.

The status of watermelons in the vegetable kingdom has just been established. Some months ago a car load of melons was shipped from Mexico to this country. By the impost laws fruits are admitted free, and vegetables are taxed 20 per cent *ad valorem*. The custom officers decided melons to be a vegetable, and imposed the tax. The Santa Fé appealed, and the government advisory board at New York in deciding held that melons were fruit. The decision is an erudite affair in which hotel *menus*, seedsmen's catalogues and fruiterers' classifications figure prominently.



One or two large deals have characterized the packing house news of the month, which may affect the business materially in the west. The greatest of these deals is the sale of the National Stock Yards, at East St. Louis, Ill., to a Chicago syndicate, at the head of which is Nelson Morris, of Nelson Morris & Co., beef dressers operating in both Chicago and East St. Louis. S. W. Allerton, also of Chicago, and Messrs. Swift and Hammond are also in the deal, though Morris holds control of a majority of the stock. The syndicate represents $30,000,000 of capital, though the purchase was made for about $500,000. The National Stock Yards Co., of whom Morris bought, was organized in 1874, and owned 650 acres of land one mile north of East St. Louis. It is said a monster slaughtering house will be erected by the new owners.

Not much has been heard during the month of the new stock yards at Stickney (Chicago) and the removal by the "small packers" of their houses to the new yards; but the mangement of that deal insist that the yards will be fitted up for business as contemplated.

It is announced that the meat inspection law of last year is to be modified so as to make the general government responsible for the brands certifying to an inspection, our foreign buyers not being satisfied with private inspection, however thorough. The great packing houses have exhibited the utmost care in the preparation of their meats, and there is every reason to believe that their products are as wholesome as can be found in any part of the world. Yet if a government certificate of inspection can add a guaranty of the thoroughness it is clearly the duty of the government to give its certificate of health to those meats its officially appointed inspectors examine, and it is no doubt ready and anxious to do so. Meantime the packers themselves will undoubtedly take extra precautions to put up their meats in good condition and see that they are stored in the holds of steamers where they cannot become tainted, as they sometimes are, by contact with hides and other odorous merchandise.

The trade in Western dressed meats during the year 1891 was quite liberal, the aggregate at both Chicago and Kansas City being well maintained. Slaughterers were less hampered with apparent illegal legislation, and met with fewer obstructions to their business. Cattle, hogs and sheep have been slaughtered freely and the products distributed widely, by means of the refrigerator lines of the transportation companies and of individual slaughterers. The prejudice against Western "dressed meat" is gradually disappearing, and the consumption is gradually enlarging, especially at manufacturing centers, where the laboring classes are realizing the benefit of obtaining a good article of food at reasonable prices. The foreign trade, while larger by 50,000 quarters than in 1890 (total of 646,007 in 1891) and the largest aggregate of shipments in the history of the trade, was, however, generally regarded as an unprofitable year, and but for the fact that some of the largest firms retail their beef from hundreds of shops in the cities of Great Britain, and realize a profit from the offal of the cattle slaughtered here, the business would have shrunk to the most diminutive proportions. Nor does the future hold out a promise of great profits to be realized from the European trade. The farmers of Great Britain and Ireland, unable to compete with other more favored regions in wheat and other grain culture, have returned to cattle feeding, and during the past year 40,000 more cattle have been fed for the markets in the British Isles than in any other year in their history. There is also a growing competition in the trade by the farmers of New Zealand and the La Platte country of the Argentine Republic, both of which have already a firmly established trade in frigorized meats in England.

PACKING HOUSE NOTES.

——The Dallas, Tex., packing house, recently burned, will be rebuilt.

——The Louisville Packing Co., Louisville, Ky., will buy an ice machine.

——Work on the new packing house at Fort Madison, Iowa, is progressing.

——A movement is on foot to establish a packing house at La Junta, Colo.

——It is announced that a packing house will be built at Deadwood, S. Dak.

——The cold storage cellar of the Minneapolis, Minn., Packing Co. is completed.

——The site for the new market, Louisville, Ky., has been purchased for $35,000.

——At New Carlisle, Pa., an abattoir and packing establishment will be built.

——V. Pfeiffer, the pork packer of La Crosse, Wis., has put in additional machinery.

——The A. Sander Packing Co., Cincinnati, has been incorporated; capital, $250,000.

——The new packing house of Cheverton Bros., at Rich Hill, Mo., is almost completed.

——Burness & Parks, now located at South Omaha, Neb., are building a new packing house at St. Joseph, Mo.

——The city engineer has been ordered to prepare plans for a wholesale market building on Thomas street, St. Paul, Minn.

——The Fort Worth, Tex., Packing Co., which lately increased its capital stock, will enlarge and increase the capacity of its plant.

——The packing facilities at Cudahy's South Omaha, Neb., packing house have been increased by a lease of the old Boyd packing house.

——The Louisville, Ky., Packing Co., with $1,000,000 capital, has bought forty acres of ground for stock yards south of Louisville, Ky.

——The State Packing Co., Chicago, capital stock, $30,000, has been incorporated by Frederick W. Hale, William C. Marshall and William C. Polleroy.

——The Central Market House Co. has been organized at Lebanon, Pa.; capital, $50,000; directors, John H. Seltzer, James D. Kerr, N. P. Moyer and others.

——The Louisville Packing Co., of Chicago, has been incorporated; capital stock, $750,000; incorporators, Morris Cassaid, James P. Ward and Alfred J. McGinniss.

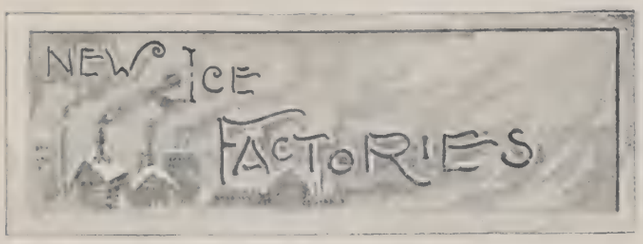
——The Rodero Packing and Provision Co. has been incorporated at Chicago; capital stock, $50,000; incorporators, Frederick S. Moffet, G. L. Hoodless and A. M. Brown.

——The Hammond Packing Co., of Hammond, Ind., which built and operated fifteen ice houses at Sturgeon Bay, has gone out of the ice business. The buildings and improvements cost $12,000.

——John P. Squires & Co., of Boston, have closed a contract with the De La Vergne Refrigerating Machine Co. for a 150-ton refrigerating machine and all the direct expansion coils for a cooling system for about 3,000,000 cubic feet.

——The stockholders of the Farmers' Market, at Twelfth and Market streets, Philadelphia, Pa., have decided to apply for a dissolution of the corporation. The Reading Terminal Co. will build a market house directly north of the present building.

——The ground for a monster slaughter and packing house in East St. Louis has been bought from the National Stock Yards Association by Kingan & Co., the European-American pork dealers, who have branches in New York, Indianapolis, Cedar Rapids and Kansas City, and four in Europe. A building to cost $1,000,000 will be erected. The company intend to use the new quarters as a hog killing station for the shipment of pork to the East.



The machine manufacturers and auxiliary supply houses uniformly report excellent business in the way of equipping new plants and in making enlargements and repairs, both of which latter are numerous.

In the South during the past year, seventy-two new ice factories have been erected, as against 157 in 1890; sixty-nine in 1889, and fifty in 1888.

In the North there is an unmistakable growth of interest in manufactured ice, and new plants are reported in several states which in January had cold enough weather to make ice galore. A company has even been organized to manufacture ice on the Kennebec river.

Our record of new plants, enlargements, etc., for the month is as follows:

ALABAMA.

Eufaula—Mr. Echols, of Huntsville, is arranging for the establishment of an ice factory.

ARKANSAS.

Little Rock—The Van Buren Ice and Coal Co. intend adding to their plant next season a 20-ton ice machine.

CALIFORNIA.

Pasadena—J. W. Morris, lately with the Citizens' Ice Co., Los Angeles, is putting up an ice factory at this place, the machine being built on the coast.

COLORADO.

Fort Collins—Certain business men are negotiating with J. W. Bailey and Dr. S. T. Quick, of Indiana, with a view to erecting an ice factory.

FLORIDA.

Leesburg—The Lake County Ice Co., Lovell Bros., are making changes to double their capacity.

Palatka—L. C. and T. J. Canova are rapidly rebuilding their ice factory, recently burned.

GEORGIA.

Atlanta—The Van Winkle Gin and Machinery Co. are erecting a 10-ton Keeling ice machine for J. C. Peck & Son.

ILLINOIS.

Charleston—The Charleston Ice Manufacturing and Cold Storage Co. has been incorporated by C. A. Dehaven, C. H. Bissell and F. B. Roder; capital, $8,000.

Chicago—The Consumers' Ice Co. have purchased two 60-ton machines from the Southern Ice Machine Co. for enlargement of the plant.

Danville—A local company has accepted plans for a 20-ton ice factory with 10,800 cubic feet of cold storage capacity additional. The plant (occupying a building 50×100 feet) is to be finished by April 1st.

Effingham—A movement has been started toward getting up a company to erect an ice factory.

INDIANA.

Marion—A company is talked of to build a 25-ton ice factory.

Noblesville—The Noblesville Ice and Light Co. have begun the erection of an ice factory, and have purchased an 8-ton machine from the York Manufacturing Co., Limited.

KENTUCKY.

Covington—The Consumers' Ice Co. will put in a 30-ton ice machine, made by the Southern Ice Machine Co., enlarging the plant to that extent.

LOUISIANA.

Algiers—The Algiers Ice Co. have let the contract for their building to be finished February 15. The ice machine (20-ton) will be made in New Orleans. The company will also operate an electric light plant.

Lake Providence—The new ice factory has been finished, tested and turned over to its owners. The Keeling machine is used, 8-ton capacity. The plant cost $12,000.

New Orleans—The Southern Ice Manufacturing Co. has bought a new 30-ton Blymyer machine and contracted for rebuilding their old machine, giving the plant a daily capacity of seventy tons. The remodeled plant is to be in running order by April 1.

Shreveport—C. W. Dawley, of Denison, and L. R. Logan, of Sherman, Tex., have been prospecting with a view to erecting an ice factory with cold storage facilities.

MAINE.

Portland—The New Bedford Artificial Ice Co., capital stock $100,000, has been organized for the purpose of manufacturing and selling ice and refrigerators. Daniel W. Scribner is president and James L. McCarthy, treasurer, both of Portland.

MARYLAND.

Cumberland—A company to build an ice factory was organized January 12, and George Schwarzenbach was elected president. The board of directors is composed of the following gentlemen: Loyd Lowndes, A. D. Ladew, George Schwarzenbach, R. R. Henderson, David Walker, C. C. Hedges, W. H. Ash and Thomas McCann. After the election of officers the contract with the Frick Co. was signed and arrangements made by which the plant will be delivered and in operation by April 1st. The company will be known as the Cumberland Ice Manufacturing Co., and its capital stock will be $30,000.

MISSOURI.

Charleston—McElroy & Hequembourg have purchased a 10-ton ice machine of Ainslie, Cochran & Co.

Pine Bluff—The Ice Factory Co. have prepared their plans for a 35-ton plant, to be completed by May 1.

NEW JERSEY.

Hoboken—The Hudson County Ice Manufacturing Co. has been incorporated by Wm. Davidson, Wm. Letts and Leonard Pfeiffer, of Hoboken. The capital stock is $200,000. The company has been organized for the purpose of manufacturing ice and producing refrigeration for general cold storage purposes.

Orange—The Distilled Water Ice Co. have completed the erection of a store house 35×58 feet; capacity, 1,000 tons.

NEW YORK.

St. George, S. I.—Edward Fesser and Henry H. Cammann, of New Brighton, have organized the Hygeia Ice Co., Staten Island, to put up an ice factory.

NORTH CAROLINA.

Raleigh—George R. Jarman, of Charleston, S.C., has bought the Plate Ice Factory, and will spend $10,000 refitting and improving the plant.

OHIO.

Cleveland—The Corning Refrigerating Co. are about to add the manufacture of ice to their cold storage business.

Urbana—The ice factory here is to be enlarged.

Youngstown—The Crystal Ice Co. has been organized with $25,000 capital; P. M. Joyce, Treas.; R. Montgomery, Pres. and Sec'y. The plant will have 25-tons capacity, and will have cold storage facilities in addition.

OREGON.

Corvallis—The Corvallis Cannery and Ice Co. have increased capital stock to $30,000, the increase having all been readily taken by local capitalists.

Salem—Klinger & Beck, of the Capital brewery, contemplate enlarging their ice making plant.

PENNSYLVANIA.

Christiana—There is talk of starting an ice factory.

York—The York Ice and Refrigerating Co. has contracted with the York Manufacturing Co. for the erection of a 30-ton ice making plant.

SOUTH CAROLINA.

Greenville—The Piedmont Ice Co., W. W. Flanders, manager, is rebuilding to enlarge the business. Mr. Flanders took charge December 1, 1891, for a term of years.

TENNESSEE.

Nashville—The Consumers' Ice, Coal and Cold Storage Co. has been incorporated, and completed its organization with B. E. Parker, V.-Pres.,; W. H. Hyronemus, Pres.; Edward Schoenpflug, Supt., and W. W. Wingel, Sec., to manufacture ice and operate a cold storage plant, etc., in East Nashville. A site has been purchased and an ice machine ordered from the Western Ice Machine Co. of Chicago.

TEXAS.

Dallas—The Dallas Ice Factory and Cold Storage Co. will put in new machinery to increase the capacity of its ice factory and cold storage plant.

Llano—The Llano Improvement and Furnace Co. has sold to H. E. Hedeman and others, of Lampasas, Tex., a piece of ground 100×140 feet, on which to locate a $15,000 ice plant. The gentlemen have purchased a 10-ton ice machine, which will be shipped and set up at once.

Taylor—Burkett & Murphy, large railroad contractors of Palestine, have purchased a 10-ton Hercules ice machine and plant complete for this city, to take the place of a Williams machine put on last spring, which will now be taken out as inadequate.

VIRGINIA.

Staunton—W. Brew wants an ice machine.

Staunton—Andrew Bowling is reported as having purchased the Staunton ice manufacturing plant, and, with others, will change the location of, renovate and operate the same.

WEST VIRGINIA.

Huntington—Mr. Shinkle is trying to organize a company to put up an ice factory.

ICY ITEMS.

——H. W. Brown has purchased the ice business of Peter Earll, Leslie, Mich.

——The North Star Refrigerator Co. has been organized to operate at Niles, Mich.

——Moses Chadburne has purchased the ice business of Hussey Bros., Dover, N. H.

——Shares of stock in the Arctic Ice Co., Newport, R. I., sold December 20 at $110 per share.

——The Tropical Refrigerator Co., Charleston, S. C., held a meeting on January 11, to increase its capital stock to $100,000.

——The Tidewater Ice Co., which controls the retail ice trade of Norfolk, Va., has been incorporated; H. B. Nichols, president.

——The Pueblo (Colo.) Ice and Cold Storage Co. announce that they resumed control of the retail delivery of their ice on January 1.

——The Lookout Ice Co., Chattanooga, Tenn., shut down since October last, resumed operations December 29; capacity, forty-five tons.

——The Tropical Fruit Co., Chicago, has been incorporated; capital stock, $25,000; incorporators, F. L. Wallace, A. A. Fox and John E. Wood.

——A deal is pending for the sale of three ice machines by the Southern Ice Machine Co., Chattanooga, Tenn., to go to Peru, South America.

——The employes of the Great Falls Ice Co., of Washington, D. C., will give a ball February 10, when they will dance to the music of the Marine band.

——The McKillop Fruit Co. has been incorporated at Barstow, Tex.; capital stock, $20,000; by John McKillop, B. H. Brant, Frank Nehles and others.

——George Moss has purchased Mr. Dunton's interest in the ice business of Dunton & Houghton, at Grinnell, Iowa, the new firm being Houghton & Moss.

——William Corah, East Aurora, N. Y., milk and ice dealer, mysteriously disappeared December 24. Financial losses create the idea that he has become insane.

——The Chicago Tropical Fruit Co. has been incorporated at Chicago; capital stock, $5,000; incorporators, F. E. Louas, W. H. Holwarz and E. T. Holwarz.

——The California Fruit Produce Co. has been incorporated at San Antonio, Tex., with a capital stock of $15,000; incorporators, D. L. and J. T. Riley and F. E. Clarke.

——The Augusta (Ga.) Ice Co. has elected D. Saucken, president, and John Saucken, manager. Mr. Haley continues as superintendent and engineer at the works.

——The Hagerstown (Md.) Ice Co., in 1890, paid a dividend of 35 per cent, and had a reserve of $2,000. Last year it paid a dividend of 4 per cent. In 1890 it turned out 2,499 tons, and in 1891, 3,000 tons.

——The Consumers' Ice Co., of Covington, Ky., has re-elected all its old directors and increased its capital stock from $50,000 to $100,000. It made 13 per cent on its capital stock and declared a dividend of 6 per cent.

——The Gorrie Ice Co., Savannah, Ga., announces the following scale of prices, taking effect January 1: For 100 pounds twenty-five cents, 50 pounds fifteen cents, 25 pounds eight cents, and under 25 pounds at the rate of forty cents a hundred.

——The stockholders of the Nashville (Tenn.) ice factory have elected the following officers and directors for the ensuing year: Allen G. Hall, president; R. H. Gordon, vice-president; E. B. Criddle, secretary and treasurer and general manager.

——The stockholders of the New Decatur (Ala.) Ice Co., January 9, elected directors, who elected L. M. Falk, president; F. M. Howard, secretary; W. W. Littlejohn, treasurer, and J. E. McBride, manager. A dividend of 8 per cent was declared.

——The Colorado Ice and Cold Storage Co., Denver, on January 12 elected a new board of directors, who organized by electing F. K. Sauers, president; Charles Wheeler, vice-president; R. W. Woodbury, treasurer, W. H. Wallace, secretary.

——P. J. Neagle, having sold his stock in the Elmira Ice Co., Elmira, N. Y., has become superintendent of the Crystal Ice Co. (Philip Weyer, proprietor), same city. Sylvester Moss, late of the Crystal Ice Co., will go into business on his own account.

——At the annual meeting of the Consumers' Ice Co., of Burlington, Mass., held January 12, a new board of directors was elected, who chose the following officers: President, H. R. Conger; secretary, C. J. Ferguson; treasurer and manager, A. O. Ferguson.

——Twin City Ice Co. and Mississippi Ice Co., of Rock Island and Moline, Ill., have consolidated as the Twin City Ice Co., with Nels Pierce, Moline, president; Henry Ehrhorn, Rock Island, treasurer, and Henry Hannecke, Moline, secretary. The capital stock was increased to $12,000.

——At the last meeting of the stockholders of the Glenwood Ice Co., Galesburg, Ill., the capital stock was increased from $30,000 to $75,000, and it was voted to buy out the Galesburg Cold Storage Co. and the Consumers' Ice Co. This step gives the Glenwood Ice Co. control of the ice trade of Peoria.

——The president of the new Western Ice Co. of Hastings, Neb., says that for next year the price to large consumers will not be reduced, but to private families the price will be made fifty cents per 100 pounds. Heretofore the price has been to small consumers all the way from sixty to eighty-five cents per 100 pounds. The company have built a lake near Ayr of about twenty acres in extent, and have erected a large ice house.

——The success of the artesian well sunk by the Central Ice Co. for the Mobile brewery has demonstrated the practicability of the artesian well system as a water supply in Mobile. The flow of the well is equivalent to about 500,000 gallons daily, and the water comes out with a pressure sufficient to force it to a height of forty or fifty feet. This well is to be followed by a second for the Mobile Ice Co., and probably others.

——At a meeting of the board of directors of the Chicago Board of Trade early in the month, the following warehouses were made regular: Baldwin packing house and Baldwin warehouse, with Chicago Packing and Provision Co. as lessee; Chicago Cold Storage and Warehouse Co.'s warehouse, C. Healy & Co.'s packing house, formerly known as Moran & Healy's packing house, with James T. Healy, known as Healy & Co., lessee.

THE FIRE RECORD.

——W. S. Head's ice house at Latrobe, Pa., was burned January 12.

——Sidney Smith's ice house, Libertytown, Ind., was burned December 20.

——Saul & Geib's ice house near Fourteenth street and Perkiomen avenue, Reading, Pa., was burned January 1; loss, $1,000.

——The ice house of the Carling Brewing and Malting Co., London, Ont., Canada, was burned December 22; cause, incendiary; insured.

——A large ice house at Dudley, Mass., owned by Geo. A. Griggs, Abington, Conn., capacity 10,000 tons, was burned December 19; loss, $500.

——Four ice houses at Silver Lake, Johnston township, belonging to the Pocasset Ice Co., of Providence, R. I., were burned January 14; loss $4,000; cause, incendiary.

——Wm. Clark & Co.'s cold storage and pork packing house, 513 Front street, San Francisco, was burned December 25; loss, $30,000; cause, supposed, fire from smoke house.

——The ice machinery house of the Chas. Theis brewery, Thirty-second and Master streets, Philadelphia, was damaged by fire and water to the extent of $5,000 on January 5; insured; cause unknown.

The Illinois Metallic Packing Co. make a specialty of an ammonia rod packing which they call "Fuel Saving, Anti-friction Metallic Packing," designed both to resist wear and to overcome the difficulty experienced in rod packing; that is, to prevent leakage of ammonia, which is not only expensive but annoying. It consists of a series of rings of anti-friction metal, of different diameters, alternating, the rings of lesser diameter fitting snugly to the piston rod, and the large ones to the stuffing box, the pressure of the glands forcing, in consequence of their form, the rings into close contact with each other and also with the surfaces they bear against, making a tight joint with a minimum of bearing surface. They are easily placed, and are guaranteed to last for years; and are sent on thirty days' trial to responsible firms.

The Sulzer-Vogt Machine Co., Louisville, builders of ice and refrigerating machinery, have just issued a new catalogue of their machinery, which contains not only descriptions of their machinery, but also drawings of floor plans for actual installations, which are useful by way of suggestion to intending builders. We notice, by the way, that some trade papers restrict their production of machines to three to six ton plants. This, of course, is a grave error, as the company is prepared to build and install plants of any size desired, either for ice making or for refrigerating purposes. Their catalogue will be mailed on application.

ICE IN MAINE.

A SHORT HISTORY OF THE ICE INDUSTRY IN MAINE—THE MEN WHO HAVE MADE THE TRADE AND HOW THEY DID IT—STATISTICS OF THE ANNUAL PRODUCTION.

By C. L. Ballard.



L. BALLARD, of Farmingdale, Me., paymaster of the Knickerbocker Ice Co., has prepared an interesting article on "Maine's Ice Industry," which will be published in the next annual report of Hon. S. W. Matthews, commissioner of labor statistics for the state of Maine, as follows:

"Years previous to the opening up of this industry in Maine the consumption of ice was small. Cities south obtained their supply at home when possible. Open winter, Boston was looked to for a supply. The first authoritative account of ice being shipped from Maine as an article of merchandise was previous to 1826, on board the brig Orion, of Gardiner. This vessel came up the Kennebec late in the fall. She was frozen in near Dearboan's wharf, Pittston, opposite Gardiner village. This vessel was loaded with floating ice during the spring, sailing for Baltimore at the opening of navigation. On arrival this cargo was sold for $700, ice and freight.

"It is said several cargoes were thus put on the market years previous to any attempt at housing for summer shipment. In 1826, Mr. Rufus K. Page, in company with Mr. Gatchell, of Hallowell, erected a building of 1,500 tons capacity on Trott's Point in Gardiner. This house they filled during that winter, employing ship carpenters and their tools mostly. During the summer it was loaded in vessels on account of the Tudors, of Boston, who consigned it to all ports of the West Indies, and southern ports. The speculation did not prove profitable to the owners, and they abandoned the business.

"In 1831 the Tudor Ice Co., of Boston, filled this same building, also erecting one on 'Long Wharf,' Gardiner, which was then just where Gardiner bridge now stands. Some 3,000 tons were stored. No other attempt at housing is reported until 1848 and 1849, when the crop failed in part in the South and Boston. The Kennebec showed quite a business winter. The Tudors again operated. Mr. W. A. Lawrence, Dr. C. W. Whitmore and Charles A. White, of Gardiner, cut and housed two lots, 2,000 tons at South Gardiner and 2,000 in Pittston. Another house was filled at Pittston and one at Bowman's point, Farmingdale and at Hallowell. Fully 10,000 tons were cut that year.

"Mr. Lawrence states it was up-hill work. He constructed a plow with one cutting tooth with guides of iron, which was a great advantage. The plow was used in making lines across the field, then with ship saws cakes were sawed about 2×4 feet. These were hoisted into the ice house by oxen.

"The following summer twenty-five men were employed loading. Fifty tons was considered a good day's work. The largest cargo was 300 tons. Six inches of sawdust were put on the bottom, top and sides of each cargo. Consignments were made to New Bedford, New York, Wilmington, Del., and Baltimore. Both lots were sold for $2.50, f. o. b. Even at this price the profits were small. From 1841 to 1860 during mild weather the harvesting showed again. New men, eager for a speculative dollar entered into the business, and each must receive some credit in introducing new ideas and tools.

"The crop failing, south, in 1860, the Kennebec was again the scene of activity. Mr. James S. Cheesman, a New York retailer and Hudson river ice man, came to the Kennebec. He immediately commenced stacking himself, and the following year commenced very extensive operations. From 1861 to 1865 he flourished wonderfully, his Farmingdale houses being visited from all parts. The capacity was increased to over 40,000 tons, steam was introduced for hoisting, and new and improved endless chains and ice tools. It is said he received as high as $12 a ton from our government for several cargoes of ice. He received much credit as the founder of Maine's ice industry. Mr. Cheesman lost his hold on the trade about 1867, and in 1868 sold his entire Farmingdale plant to the Knickerbocker Ice Co., of Philadelphia, and his Pittston houses to the same firm in 1872.

"About this time Charles Russell & Co., the Great Falls, Independence and Cochrane & Oler Cos. located on the river. Dr. D. W. Clark, of Portland, commenced operations on Sebago lake, sailing to Portland, thence by vessels south. But a few years later the Carltons and Rockport Ice Co., of Rockport, organized, and later Mr. H. M. Pierce, of Belfast. The Morse Ice Co., of Bath, commenced business previous to 1890, which company now assumes the second position in amount handled; the Knickerbocker, of Philadelphia, exceed all others in quantity, yearly. Captain A. Rich, of Farmingdale, entered the business early in the seventies, also the Haynes & DeWitt Ice Co., of Augusta.

"On the Penobscot the first housing for shipment below the dam was during the years 1879–80. Messrs. Rollins and A. D. Sargent, and E. & I. K. Stetson were among the first individuals. Corporations formed later, and to-day many large companies are doing business.

"The following figures are presented covering the harvests for ten years:

Years.	Kennebec River.	Penobscot River.	Cathance River.	Coast and Interior.	Total Maine Houses.
1881.....	690,000	81,000	20,000	180,000	971,000
1882.....	927,000	146,000	39,000	247,400	1,359,400
1883.....	931,900	112,000	22,700	297,900	1,364,500
1884.....	921,800	58,500	10,000	197,700	1,188,000
1885.....	958,000	104,500	8,000	418,900	1,490,400
1886.....	638,000	176,000	20,600	633,800	1,468,400
1887.....	793,000	151,000	50,000	317,100	1,311,100
1888.....	837,000	200,000	9,500	309,550	1,456,050
1889.....	845,000	279,000	10,000	395,600	1,529,600
1890...	1,041,200	506,300	42,300	1,102,600	3,092,400

The decision in the Counselman case—that neither the railroad company giving nor the shipper receiving a cut rate can be compelled to testify and thus incriminate themselves—practically wipes out the inter-state commerce law, since, of course, it is practically impossible to secure outside testimony sufficient to insure a conviction on an indictment for violation of the law.



While the mild weather of December and the first few days of January, felt through the West and Northwest, and the freshet which removed the ice that about the middle of December formed in the Maine rivers, gave rise to a reasonable apprehension that there might be a scarcity of ice and a short crop, the weather which the country has experienced since about the 5th of January up to this writing, January 25, has removed all cause for alarm; and there is now every reason to believe that the crop will be not only large but excellent in quality. In the West cold weather began about January 2, followed by a Manitoba type of "zephyr" which swept over the country, beginning on the 10th, and increasing in severity until the 20th, and brought with it a lower temperature to some localities than has been felt in those sections for several years. The night of the 18th was the coldest of the month. At St. Paul the mercury fell to 25° below zero, and at 7 A. M. on the 19th stood at —27°, with one exception the lowest point reached since January 21, 1888, when the thermometer registered —41°. This extraordinary cold was felt not only in Minnesota and Dakota but all over the country west of the Alleghenies, from the lakes to the gulf. At Kansas City on the 19th the register was as low as —25°. At Guthrie, O. T., on the 18th, —4° was recorded, the lowest temperature ever known in the territory, six inches of snow falling. At Florence, Ala., the first snow since 1888, heavy enough to make good sleighing, fell on the 18th. At Austin, Tex., on the 18th, 20° was recorded, with a stiff norther blowing and the mercury falling. As early as the 14th the Mississippi river at St. Louis was frozen over, the first time in four years. On the 20th New Orleans had a heavy snow and sleet storm, and the coldest weather in many years was reported from all that portion of the South, this particular cold snap having previously (about January 12 and 13) been preceded by exceptionally heavy snow and cold weather all through the south—in Texas the severest known in fifteen years.

It was not, however, until the 19th and 20th that the cold wave in its severity reached and passed the Alleghenies. On the 16th, the Penobscot,—which was first closed to navigation December 16 and was afterward opened partly by mild weather and partly by design of the ice men, so that boats continued their trips from Bangor to Boston—was again frozen over and closed to vessels by clear, clean and smooth ice. At New York the first ice of the season appeared in the lower bay at Staten Island on the 19th, which was thin and floating. Navigation on the Hudson closed on Sunday night, January 17. In 1890 the Ramsdell line made the last trip of the season on Christmas, and the first trip of the 1891 season was made February 23.

Thus it will be seen that every part of the nation north of the Ohio river (and also some territory south of that stream), from Maine to the Sierras, has had at least two weeks, and generally more, of ice making weather, during most of which time ice from eight to eighteen inches has been made, with ample time for a full harvest by wide-awake men.

And what is more, the crop has been well harvested. Without waiting for colder weather or thicker ice, dealers and heavy consumers, such as the packers, brewers and cold storage men, particularly in the West, were generally prepared to take advantage of the first crop fit to pack, and went at the harvest with all haste. In cities like Kansas City and St. Joseph, etc., where ice better than six inches is rare, every available man and team was hired to hasten the pack of ice from eight to twelve inches in thickness; and generally throughout the country the same haste to make sure of a crop excellent in quality and of good thickness was exhibited; and during the two weeks ending January 23 heavy stocks were harvested at or near nearly every city of any size or importance in the entire West and Northwest and northern section of the Southwest.

"Old Lee," our special correspondent from Grand Rapids, Mich., January 23, says: "The continued cold weather for the past three weeks has made but little ice in this section. The fall of snow has kept ice from making to any extent. Some six to seven inches of inferior ice is being taken from ponds. Lake ice is now about five inches thick. A few more days of cold weather, however, will give us good ice. From the present outlook, we will have a big harvest. South Grand Rapids Ice and Coal Co. has just changed hands. A. B. Knowlson, J. M. Barnett and Joseph Horner have absorbed all the stock of this company's except some few scattering shares. These parties are wide-awake, hustling business men, with broad business principles. They will no doubt enjoy a large, lucrative business, as they have every facility for handling ice at minimum cost. A new copartnership has just been formed between James Grant and C. C. Follmer. This company will be known as the Grant Ice Co. They have obtained a valuable ice privilege at Reed's lake, about three miles from the city, and are erecting three large ice houses, with all modern improvements. Magoon & Kimble Co., Muskegon, Mich., are erecting a first-class ice house at Mona lake; capacity, about 4,000 tons."

In Maine and on the Hudson the ice dealers of both sections are (January 25) still waiting for the ice to reach the desired thickness, with every detail ready to house the crop rapidly. At this time last year a large part of the harvest had been made, and therefore the dealers this season have been watching the weather anxiously. The cold snap of January 18 to 20 has, however, removed anxiety in great part; and while the cut has, in the main, yet to be made, there is little reason to doubt that it will be made and a full crop housed in both sections, the weather being very favorable in both states.

In our news notes we cannot, of course, undertake to even outline the size and character of the crop gathered at the hundreds of places from which we have received advices; but will note only the larger centers. It may be said, however, that the reports are practically unanimous in the statement that a full crop has been gathered in under the most favorable auspices.

NATURAL ICE NEWS.

——Dayton, Ohio, ice men put up 6-inch ice.

——Boskopp Bros. have built a new house at Mt. Clemens, Mich.

——The C. & A. R. R. has built a large ice house at Bloomington, Ill.

——Webster & Son are putting up a new house at Lime lake, N. Y.

——J. P. Sullivan, of Buffalo, has built a new house at Concord, N. Y.

——The C. & N. W. Railroad Co. have put up 10,000 tons at Clinton, Iowa.

——Ottawa, Kan., has harvested its own ice for the first time in three years.

——In Missouri considerable ice was put up, some of it as thick as eight inches.

——In quite a number of Virginia and Kentucky towns a fair crop of thin ice was put up.

——Wm. Green & Son propose to fill ten large houses at Holly, Mich. This is new territory.

——The Russell Lake Ice Co. and Mr. Wilcox have consolidated their business at Great Bend, Kan.

——A new house has been erected at Dr. Cropp's ranch, Walla Walla, Wash., and 500 tons stored.

——H. F. Johnson & Co., Pendleton, Ore., have built an ice house and will go into the retail business this season.

——The Union Ice Co., of Denver, has been incorporated by F. C. Timsor, D. D. Lake and others; capital, $25,000.

——John Peterson is building an ice house at Monmouth, Ill. The ice for Monmouth is cut on the Mississippi river.

——Up to January 11 no ice had been cut in Canada, but a week later the harvest was in full blast on the St. Lawrence.

——The Ontario & Western R. R. Co. will erect a house at Oneida, N.Y., to furnish ice to milk patrons and to ice milk trains.

——The Rockford Ice Co., Rockford, Ill., capital, $20,000, has been incorporated by Frank J. Leonard, L. H. Billings and Howard W. Hull.

——The Kenton, Ohio, ice dealers put up 20,000 tons of 6-inch ice, while the Cold Storage Co. and butchers laid in a full supply of about the same thickness.

——Reports from Nebraska along the line of the Missouri Pacific state that a good crop of ice has been harvested at an average thickness of twelve inches.

——A large cut of 3-inch ice was made on the ponds in the suburbs of Baltimore; quality, fairly good. Several other Maryland towns cut 2½ to 5-inch ice.

——The Jacques Center Lake Ice Co., of Warsaw, Ind., has been incorporated by Oliver P. Jacques, Thos. Wood, Andrew G. Wood and others; capital, $20,000.

——An immense amount of ice was cut on the Mississippi at Quincy, Ill., which the "Q" road made every preparation to handle. About 1,000 men and 200 teams were employed.

——At the lakes near Atchison, Kan., some of which have not yielded ice for three years, 1,000 men were at work January 14 cutting 8-inch ice for the Kansas City packing houses.

——Moline dealers, who formerly have had a big trade at St. Louis and Quincy, anticipate that the crop harvested at home in those cities will cut into that part of their trade next summer.

——The Independent Ice Co., of Indianapolis, at Lake Cicott, near Logansport, put up 5,000 tons of ice for the Pan Handle Railroad Co., and 3,000 tons for themselves. They used steam elevators. The ice was at least seven inches thick.

——The Santa Fe road has enlarged its ice house at Newton, Kan., making it the largest on the system between Chicago and Los Angeles. The harvest was made by steam, 500 men being employed, working day and night, by electric light.

——In southern Pennsylvania, South Bethlehem and Westchester, the houses were filled with 4 and 5-inch ice. At Erie the ice and fish dealers began cutting on the 12th, the ice being very clear and solid, but only six inches thick. Large quantities were cut there also for Pittsburgh and intermediate towns. At York 6-inch ice was cut.

——The crop in New Hampshire was not harvested by the 15th nor cutting begun to any great extent, but the prospects were good. The size of the cut will depend somewhat on the freight rate from the fields to Boston, which last year was $1 per ton. One train load from Wolfborough Junction to the Drivers' Union was shipped on the 10th, however, and another on the 11th.

——The National Ice Co. has been organized at San Francisco, to deal in ice. The company proposes to compete with the Union Ice Co. of the same city for the ice trade of the coast, and will supply their customers with either natural or manufactured ice. C. A. Buck is president, and W. Jungbluth, secretary, the company's headquarters being at San Francisco.

——On January 12 there was 5½-inch ice on Sugar and Bean lakes, which supply Kansas City with natural ice, and the week or ten days following made the ice still better, reaching twelve inches at least, the weather having been exceptionally cold. Six-inch ice in that section is the best that is usually cut. The harvest was, therefore, an extraordinarily good one, and an exceptionally large cut was made.

——At St. Joseph, Mo., beginning on the 15th, wagons, sleds, ambulances and conveyances of all descriptions were pressed into service, and immense quantities of ice was hauled from the river and from private ice ponds adjacent to the city by the ice dealers, while the proprietors of the breweries, the railroad companies and many private parties were also busily at work filling their ice houses. The ice was about eight inches thick, firm and of a good quality.

——Ice cutting on the water reservoirs at Omaha began January 10, of ice ten to fourteen inches thick. The Kimball Ice Co. had a force of about forty-five men on the reservoirs. The Crystal Ice Co. had 150 men at work on the lake, while the Swift, Hammond and other companies made a large cut. Some of the dealers cut from the river. Ice cutting below the mouth of the North Omaha sewer is forbidden. The harvest is said to have been the quickest on record.

——All through Nebraska the minor towns and villages report an ample harvest of ice, for the coming season's use, at least. At South Omaha the crop was a good one, and all the packers secured their required supply from 10¼ to 13 inches thick. Swift & Co., who also cut Cudahy's supplies, have a large tract of low land so arranged that it can be flooded just as desired. As soon as one crop has been removed the flood gates are opened and fresh water is allowed to run in. It soon freezes and in this way, during cold weather, an endless supply is always on hand. During a warm season these two packing houses use hundreds of tons of ice daily, in addition to keeping their refrigerating machines for freezing in operation. The ammonia process is used for the cooling rooms, while the ice is stored to cool their dressed meat cars.

——At Indianapolis, beginning on the 18th, the citizens of that city for a week witnessed a sight they have not before seen in four years—wagons loaded with clear blocks of ice wending their way toward the brewery ice cellars. Every team available in the city and the surrounding country had employment, and hundreds more could have been given work. There was no possible excuse for idleness either among men, for the various local ice men were ready and willing to give employment to all who asked for it. The breweries got their ice from ponds just northwest of the city, which were filled by waters from the canal. The great ice houses along the canal bank and at Broad Ripple are filled with ice and packed as tightly as possible. There was no waiting for a colder snap, as the ice men simply gorged themselves at this first opportunity for five years. At Lake Maxinkuckee ice was cut from twelve to fourteen inches thick, and reports say it is as clear as crystal. At Warsaw and at Turkey lake immense quantities were cut. At both these places the railroad companies running through have large storehouses.

——The cut in Wisconsin has been uniformly good, and the crop harvested very large, some of the ice being twenty-two inches. Cutting at Racine began on the 6th, but the quality was poor compared with that cut later in the month. In the immediate neighborhood of Milwaukee cutting began on the 12th, with 10-inch ice, the Wisconsin Lakes Co. having 500 men at work, the first cutting being for cold storage purposes. The Sudmeister Ice Co., of Chicago, will fill four new houses at Menasha, with 12-inch ice. At Palmyra cutting for local and Chicago consumption began on the 9th, the ice (10-inch) being, however, of inferior quality. The Superior Co. cut 18-inch ice. From the preparations made it would look as though the ice harvest from Chequamegon bay would exceed that of last year. The Lake Superior Crystal Ice Co. will harvest 4,000 tons; the Chequamegon Ice Co. have placed their harvest at 30,000 tons; Sargent & Co. at 7,000 tons. At Oshkosh, M. A. Searl, on the 10th, finished a new house. The ice on Winnebago lake, where two years ago twenty firms shipping to Chicago, St. Louis and Cleveland got their harvest, was thirteen inches on the 11th. It is doubtful if the cut this year equals that of two years ago, however, many of the dealers being able to get their supplies nearer home.

——All through northern and central Illinois the harvest has been large and very fine. Ice cutting began with 9-inch ice, but the bulk of the crop was of ice from twelve to fifteen inches in thickness. At Springfield, for the first time in three years, ice cutting began on the 11th, 100 men being at work on Sangamon river. The Huse-Loomis Ice Co. began work at Alton on the 10th with ice at six inches. At Pekin and Peoria cutting began on the 12th; at Ottawa on the 14th, cutting both for Ottawa and Streator, 15-inch ice being harvested. At Bloomington small consumers began cutting at Brewers' pond on the 12th, with ice at five to six inches. The local paper said that day: "It is understood that not a great deal of natural ice will be put up in this city this winter, except by persons who have small ice houses, which they desire to fill, except in case the weather continues cold, in which event one dealer said he might cut and store quite a quantity of ice for sale here next summer." At Yorkville the large houses there, owned by a Chicago company, were filled for the first time in three or four years. At Rockford cutting began on the 12th, with prospects good for a large crop. At Elgin, cutting began a week later by the dealers, but the brewery and cold storage men began on the 12th. At Moline cutting did not begin until about the 20th. Pekin is cutting also for the southern trade.



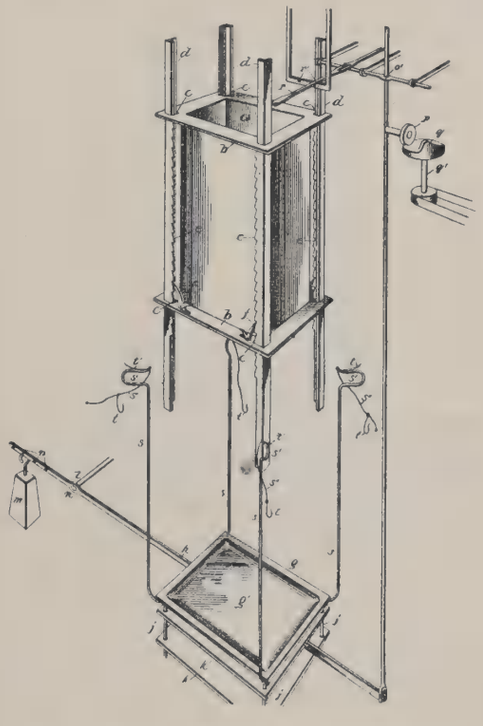
We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

MACHINE FOR PACKING ICE.

No. 466755. Samuel Kaye, Yazoo City, Miss. Filed November 29, 1890. Serial No. 373,053. Patented January 5, 1892. (No model.)

Claim.—1. In an ice packing machine, a vibrating platform and sack holders, in combination with tamping bars adapted to enter the sack and to work out of the sawdust by the action of the platform.

2. In an ice packing machine, a vibrating platform provided with sack holding devices, substantially as described, in combination with tamping bars having pawl-and-rachet mechanism, whereby the sawdust is packed by the weight of the bars, as and for the purpose described.

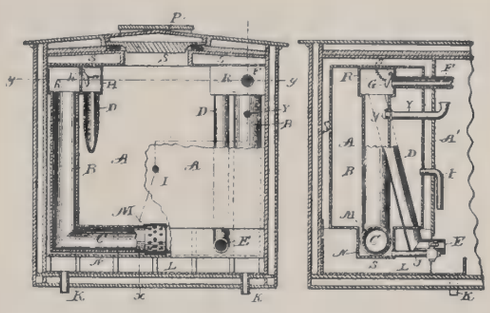


3. In an ice packing machine, the combination of a vibrating platform provided with sack holders, tamping bars having pawl-and-ratchet mechanism, guides for said bars, and a counterbalancing weight for the platform, as and for the purpose described.

REFRIGERATOR CAR.

No. 466,794. Martin S. Millard, Kansas City, Mo. Filed September 10, 1891. Serial No. 405,335. Patented January 12, 1892. (No model.)

Claim.—1. In a refrigerator, the combination of a tank adapted to contain a refrigerant, water pipes arranged within and communicating with the interior thereof, air pipes arranged within and communicating with the air outside of the tank, and valves for permitting passage of air in one direction through the air pipes, substantially as shown and described.



2. In a refrigerator, the combination of a tank adapted to contain a refrigerant, water pipes arranged in said tank and communicating with the interior thereof, valve boxes receiving the upper ends of the water pipes, air pipes extending from said valve boxes through the tank near its lower end, pipes connecting the valve boxes with the surrounding air, and valves arranged in the valve boxes, substantially as shown and described, for the purpose specified.

A COMPANY has been organized at Philadelphia, of which Frank McKeone, of the firm of McKeone Bros., is a prominent member, who will apply for a franchise for laying pipes for a pipe line refrigerating plant, similar in design and purposes to the pipe line plants now in operation in St. Louis and Denver, with which our readers are familiar. Mr. McKeone expects to have the plant in operation by May 1.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $3 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Condenser for Sale.

For sale, a submerged condenser used only one season, consisting of 8,500 feet of one-inch pipe. Will be sold at a bargain. DIAMOND ICE COMPANY, Wilmington, Delaware.

For Sale at a Bargain.

A new 15-ton ice or refrigerating plant, consisting of one 14x30 Corliss engine, and one 12x24 ammonia compressor; 10,000-lb. fly wheel and foundation plates. Address FRANK TOOMEY, 131 N. 3d st., Philadelphia, Pa.

Draughtsman Wanted.

A mechanical draughtsman for refrigerating and ice machine work. Must have practical knowledge and experience in laying out pipe work. Address "C. B. R.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Practical Cold Storage Man Wanted.

To take charge of a 50-ton cold storage plant. Must understand the business thoroughly, and furnish good references. Will pay the right man a good salary. Address "STORAGE," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Ice Machine Supply Business for Sale.

A well established ice machine supply business, with a large correspondence paying handsomely, will be sold cheap. Small capital required. Must go south on account of health. Address "SUPPLY," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Situation as Engineer.

A thorough practical engineer, now in charge of a 100-ton ice making plant, would like to make a change. Can give the very best references. Would prefer to go south of the Ohio and east of the Mississippi rivers. Address "A. Z.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Construction of Cold Storage Plants.

My articles in this magazine having drawn applications from parties about the country for erecting cold storage plants for them, upon my system, as outlined in August number of this magazine, I have disposed of my plant and arranged to meet this demand by contracting to construct such plants, affording demand of temperatures and drier air than any other ice system can give. Correspondence solicited. D. B. BEEMER, Omaha.

NOW IS THE TIME

WRITE FOR PRICES AND PARTICULARS

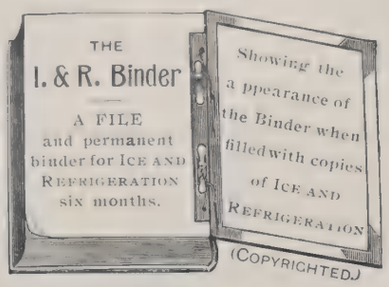
To repair and fix up coils, tanks, etc., for hot weather. For such work nothing protects as well as BONNELL'S NUBIAN IRON ENAMEL Cheapest and best coating ever made. In use for thirteen years with constantly increasing demand.

77 Warren St., NEW YORK. THE NUBIAN IRON ENAMEL CO., 17 TO 19 NUBIAN AVENUE, (A CHICAGO SUBURB.) CRAGIN, ILL.

THE

I and R BINDER

FOR 1892



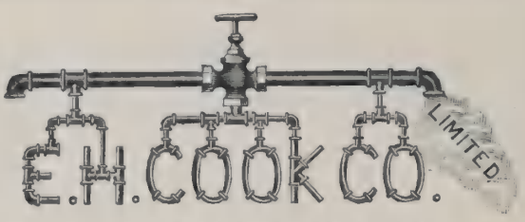
Save your COPIES OF Ice AND Refrigeration

FOR FUTURE REFERENCE.

EACH VOLUME IS FULLY INDEXED AND MAKES A VALUABLE WORK OF REFERENCE.

Binders holding six copies (one volume), $1.00 each, post-paid.

ADDRESS **H. S. RICH & CO.**, PUBLISHERS,
177 La Salle Street, CHICAGO.



ENGINEERS AND CONTRACTORS FOR

Hot Water and Steam Heating

Ventilating

ALSO ALL KINDS OF PIPING FOR

BREWERIES

WATER, STEAM AND GAS.

Greenhouse Heating & Steam Laundry Work

PUMPS

DAMPER REGULATORS, FEED WATER HEATERS, AND ALL KINDS OF ENGINEERS' SUPPLIES.

92 and 94 Andrews Street,

ROCHESTER, N. Y.

GRAPHITE PIPE JOINT GREASE

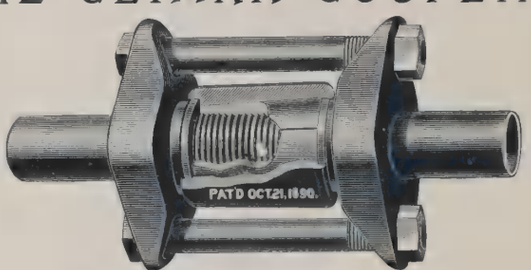
SEND FOR OUR CIRCULAR.

INSTEAD OF RED LEAD.

GUARANTEED MANY TIMES BETTER.

JOS. DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.
Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,
229 FULTON STREET,
SAN FRANCISCO, CAL



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY
Omnibus and Wagon
MFG. CO.
Builders of all Kinds of Vehicles.
Cor. Charles and Plum Sts.,
CINCINNATI, O.

PHOSPHOR BRONZE BEARINGS

SPECIALLY FOR

ICE MACHINES

MANUFACTURED BY

PAUL S. REEVES

PHILADELPHIA.

BABBITS AND PHOS. BRONZE CASTINGS FROM 1 LB. TO 2000 LBS. IN WEIGHT

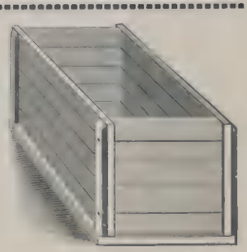


GEO. WOOLFORD, Manufacturer of all kinds of

Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES,
COLD STORAGE HOUSES
RAILROADS, PACKERS,
CHEMICAL WORKS, ETC.



2240, 2242 and 2244 North 9th Street, PHILADELPHIA.

AUG. MARITZEN,

Engineer and Architect

WILL FURNISH ON SHORT NOTICE ALL PLANS, SPECIFICATIONS AND ESTIMATES FOR COMPLETE . .

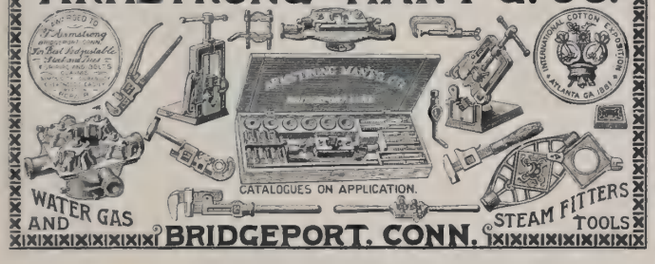
COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

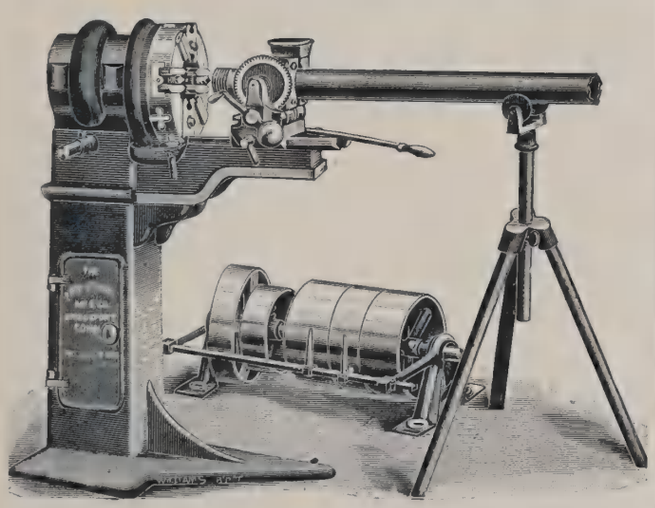
ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE.
Chicago, Ill.

BEST OF REFERENCES FURNISHED AND SATISFACTION GUARANTEED. . . . .

ARMSTRONG MAN'F'G. CO.



WATER GAS AND STEAM FITTERS TOOLS
BRIDGEPORT, CONN.



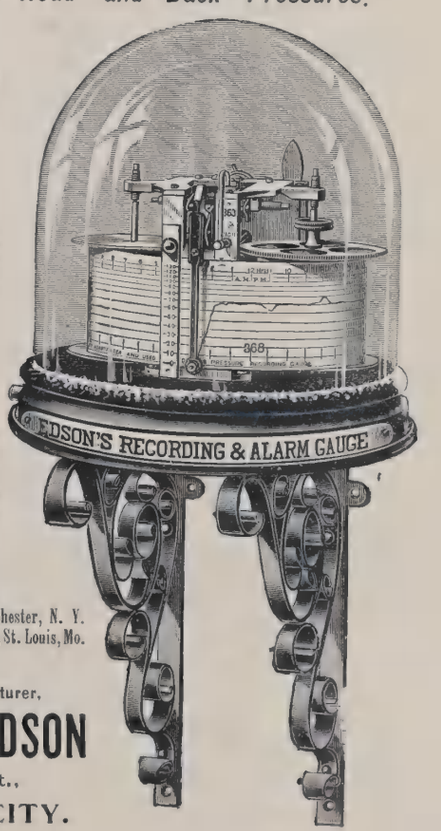
Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

--- EDSON'S ---

AMMONIA RECORDERS

For Recording "Head" and "Back" Pressures.



Endorsed and Recommended
BY THE
De La Vergne Refrigerating Machine Co.

As being indispensable in enabling the owner of an ice plant to keep the same in hand, and giving him thorough control over it.

I REFER

To the following patrons:

Lion Brewery . . . . . New York
Jacob Ruppert . . . . . New York
A. Hupfel's Son . . . . . New York
Consumers' Bg. Co. Ltd., New York
Long Island Brewery. . Brooklyn
J. & P. Baltz Brg. Co., Philadelphia
Wm. J. Lemp . . . . . St. Louis
Wm. Peter Bg. Co., Weehawken, N. J.
Diamond Ice Co., Wilmington, Del.
Fred Miller Brg. Co. . . Milwaukee
Bartholomay Brg. Co. . . . . Rochester, N. Y.
East St. Louis Ice & Cold Stor. Co., St. Louis, Mo.
ETC. ETC.

Address Sole Manufacturer,

JARVIS B. EDSON
87 Liberty St.,
NEW YORK CITY.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, 125 Tons daily. Big Spring Ice Co.
Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

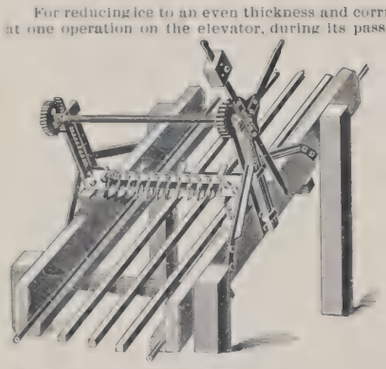
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house



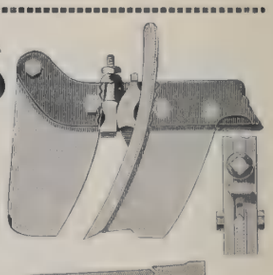
It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

ICE TOOLS



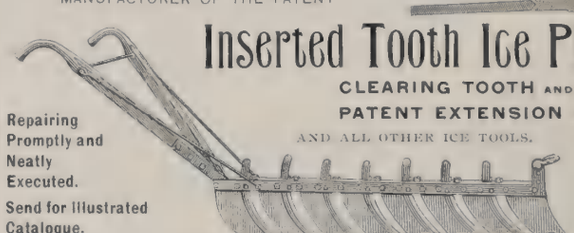
HENRY BODENSTEIN,
MANUFACTURER,
Staatsburg, Dutchess Co., N. Y.

MANUFACTURER OF THE PATENT

Inserted Tooth Ice Plows

CLEARING TOOTH AND PATENT EXTENSION GAUGE

AND ALL OTHER ICE TOOLS.



Repairing Promptly and Neatly Executed.

Send for Illustrated Catalogue.

All Work Warranted to Give Satisfaction

ICE TOOLS



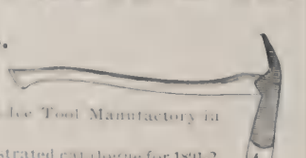
FOR HARVESTING AND FOR DELIVERING ICE.

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.

Send for complete illustrated catalogue for 1891-2.

PETER GERLACH & CO.

CLEVELAND, OHIO.

MANUFACTURERS OF THE FINEST

ICE TOOLS

.....FOR.....

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.



SEND FOR PRICE LIST.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

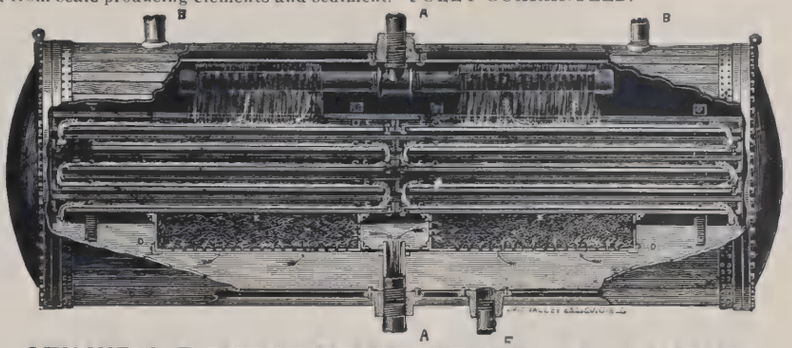
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

THE F. L. GALIGHER COMPANY,

ICE and REFRIGERATING MACHINE SUPPLIES

Machines Purchased, Erected and Results Guaranteed.

CAPACITY OF PLANTS INCREASED AT A MINIMUM COST.

Repairs and Alterations Made.

. Perfected Distilled Water Apparatus for Ice Factories Pure Water Co.'s, Chemists, and Caraffe Freezing.

EXPERTS FURNISHED. CORRESPONDENCE SOLICITED.

ROOM 709
CHAMBER OF COMMERCE BUILDING,
CHICAGO, ILL.

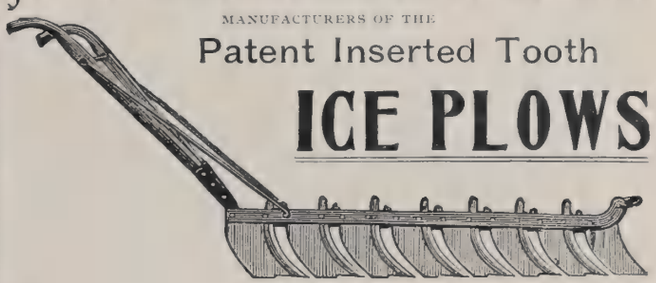
BRANCH OFFICE, N. W. COR. THIRD & MAIN STS., CINCINNATI.

J. G. BODENSTEIN & CO.

MANUFACTURERS OF THE

Patent Inserted Tooth

ICE PLOWS



OLD STYLE PLOWS, AND ALL OTHER ICE TOOLS

Before purchasing elsewhere send for our descriptive catalogue and price list.

STAATSBURG, N. Y.

CRANE COMPANY, CHICAGO.

SPECIAL WROUGHT IRON PIPE

. . . . . For Ice Making and Cold Storage.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice and Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,
CHICAGO.

J. M. WESTERLIN. ALLAN CAMPBELL.

WESTERLIN & CAMPBELL,

Consulting Engineers & Contractors

FOR

ICE MAKING AND REFRIGERATING MACHINERY,

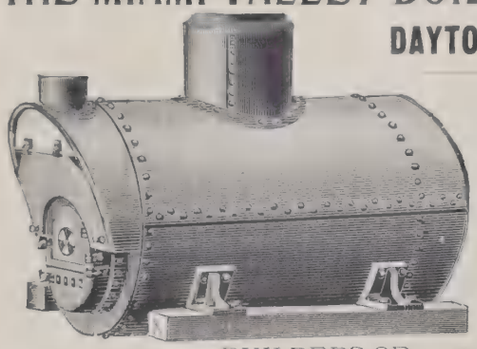
26 West Lake Street, Room 11,

CHICAGO.

AMMONIA FITTINGS AND ICE MACHINE SUPPLIES. PIPE WORK, REPAIRS, TESTS AND ALTERATIONS A SPECIALTY. PLANS, SPECIFICATIONS AND ESTIMATES PROMPTLY FURNISHED.

THE MIAMI VALLEY BOILER CO.

DAYTON, OHIO.



We guarantee all work to be first-class and prompt.

ESTIMATES GIVEN.

PLEASE ASK FOR PRICES.

BUILDERS OF

Stand Pipes, Boilers and Ice Tanks.

TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.

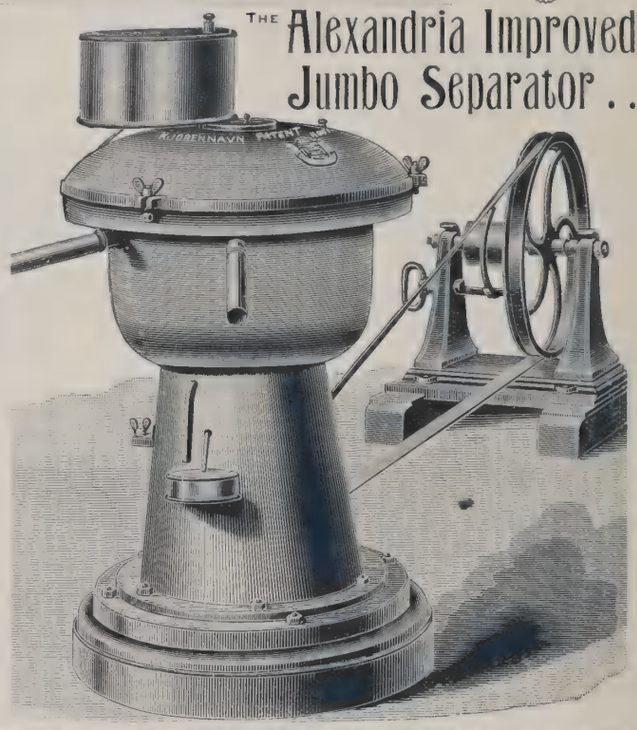


CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.

ATTENTION, CREAMERIES!!!

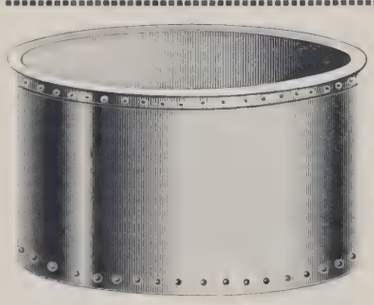
THE Alexandria Improved Jumbo Separator..



THE ALEXANDRIA IMPROVED JUMBO SEPARATOR has the largest capacity of any machine in the world, with this size bowl, viz.: 15. With a speed of 6,500 revolutions per minute it will separate 2,500 to 3,000 lbs. per hour. Two horse power will run it. We guarantee this machine in every respect; material, workmanship and separation of cream perfect. The bowl of this separator is forged from steel made especially for this machine. If you need a large separator, call on us. We control the Nelson & Peterson and the Stephens Patent for the U. S. of the Alexandria and Jumbo Separators.

DAVIS & RANKIN BLDG. AND MFG. CO.

240 TO 254 WEST LAKE STREET, CHICAGO.

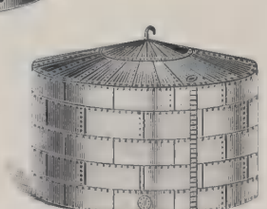


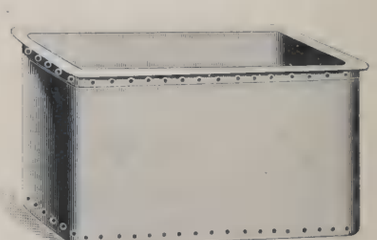
WM. GRAVER TANK WORKS.

INCORPORATED

MANUFACTURERS OF.....

IRON AND STEEL **STORAGE TANKS**





WORKS:

EAST CHICAGO, IND.

ON BELT LINE, CONNECTING WITH ALL CHICAGO RY'S.

OFFICES

334 & 336 Rookery,

CHICAGO, ILL.

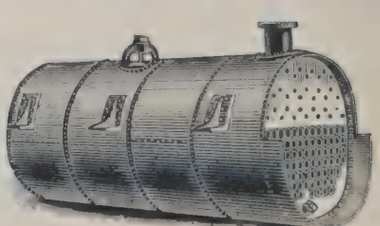
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.



MANUFACTURERS OF

COMPOUND CONDENSING AUTOMATIC ENGINES.

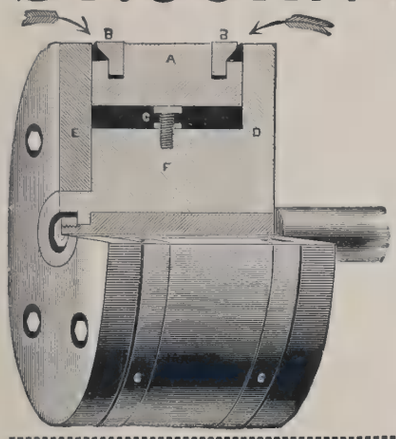


CORRESPONDENCE SOLICITED

BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.

ST. JOHN CYLINDER PACKING CO.



MANUFACTURE A PACKING SPECIALLY ADAPTED TO ALL CLASSES AND SIZES OF . . . . . .

MARINE, LAND AND LOCOMOTIVE ENGINES, AIR COMPRESSORS, WATER, OIL AND AMMONIA PUMPS.

Insures perfectly tight pistons with minimum friction, and is self-adjusting. It increases the power of engines ten per cent, and saves fuel, oil and cost of repairs. It wears the cylinder round and true, and renders reboring unnecessary.

Highest and only awards International Exhibitions, Edinburgh and London, 1890; Special Medal of Superiority, American Institute, New York, 1888 and 1889; Massachusetts Charitable Mechanics' Association, Boston, 1890.

SEND FOR DESCRIPTIVE CIRCULARS AND PRICE LIST.

D. DeKREMEN, Sales Agent 280 Broadway, NEW YORK.

SELDEN'S PATENT PACKINGS FOR STUFFING BOXES



A. Chalmers, chief engineer for the Arctic Ice Co. South avenue, Allegheny, Dec. 14, 1891, wrote to Randolph Brandt as follows: "I have used the Selden's patent packing on the ammonia rods of the ice machine for the last nine years, and find it to be the best and most lasting packing I can find for ammonia rods."

RANDOLPH BRANDT,
38 Cortlandt Street,
NEW YORK, U. S. A.

Globe Packing

FOR REFRIGERATING AND ICE MACHINES.



The Best Packing Made FOR STEAM, WATER AND AMMONIA.

None genuine without the TRADE MARK on the muslin cover.

Ask your supply dealer for it or order direct.

SEND FOR SAMPLE.

MANUFACTURED ONLY BY

J. H. BILLINGTON & CO.
PHILADELPHIA, PA.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

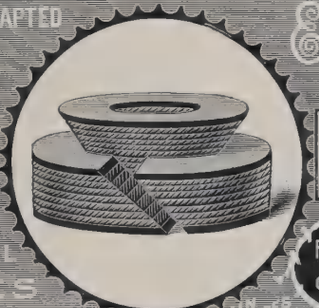
69 FRANKFORT,

CLEVELAND, OHIO.

THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.

EQUALED BY NONE







MAIN OFFICES

PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 191 WATER ST. | CHICAGO 91 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

AMMONIA ROD PACKING

Saves Fuel — ANTI-FRICTION METALLIC PACKING — Frictionless

CHEAP LASTS FOR YEARS CHEAP

AT LAST A PACKING HAS BEEN INVENTED THAT WILL PACK AMMONIA RODS

Satisfactorily and Economically.

ALL KINDS OF PISTON RODS PACKED.

ILLINOIS METALLIC PACKING CO.
103 TRADERS' BUILDING,
CHICAGO.

Send for Price List and Description.

READ WHAT ONE OF OUR CUSTOMERS SAYS.

CHICAGO, December 12, 1891.

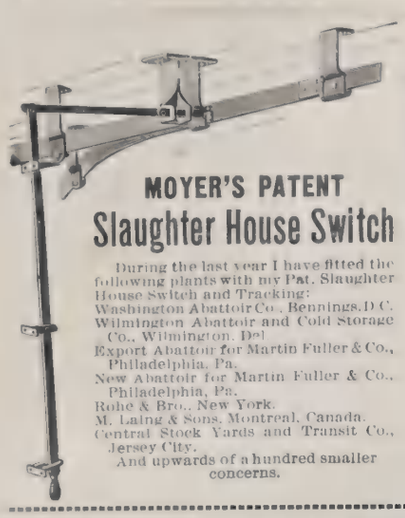
ILLINOIS METALLIC PACKING CO., CHICAGO.

GENTLEMEN: In reply to yours of recent date, am glad to be able to state that the Ammonia Rod you packed with your Anti-Friction Metallic Packing is running very satisfactory. *After a trial of a number of other packings on this rod,* none of which were a success, I can truthfully state that I *consider your packing as being unequaled for ammonia rods, as well as for other rods, pumps and engines.* Wishing you the success you deserve with your packing, I am,

Yours respectfully,

CHAS. B. FAIR, Chief Engineer.

CONSUMERS' PURE ICE CO.



MOYER'S PATENT
Slaughter House Switch

During the last year I have fitted the following plants with my Pat. Slaughter House Switch and Tracking:
Washington Abattoir Co., Bennings, D. C.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
Export Abattoir for Martin Fuller & Co., Philadelphia, Pa.
New Abattoir for Martin Fuller & Co., Philadelphia, Pa.
Rohe & Bro., New York.
M. Laing & Sons, Montreal, Canada.
Central Stock Yards and Transit Co., Jersey City.
And upwards of a hundred smaller concerns.



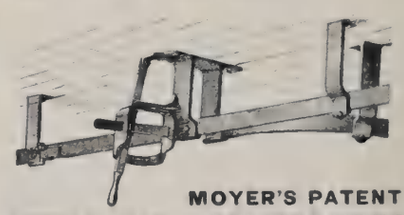
J. W. MOYER,

14 SOUTH BROAD STREET, PHILADELPHIA, PA.

MANUFACTURER OF

Overhead Tracking Switches AND Trolleys for Abattoirs, Refrigerators and Packing Houses

When using this Hanger the track is not required to be drilled, as it is held in position by a clamp bolt, thereby saving the cost of drilling. It affords a cheap and simple manner of erecting the tracking.



MOYER'S PATENT
SWITCH FOR LOW TRACKING.

Generally used where quarters of beef, hogs, or sheep are stored, and can be set up in any part of the room. It is fitted up and put together at the factory, so all that is necessary to erect it is to fasten the hanger to the ceiling and the switch is ready for use. This can be done in twenty minutes.



MARIS MACHINE CO.

PHILADELPHIA, PA.

MANUFACTURERS OF

CRANES

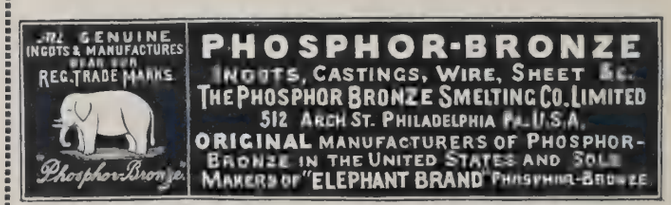
POWER BRIDGE CRANES
HAND BRIDGE CRANES

FOR USE OVER FREEZING TANKS.

PORTABLE . HOISTS

Holds Load at any Point.

Overhead Track, Trolleys, Switches.



D. F. KENLY & CO.

ICE MACHINE and BREWERS' WORK A SPECIALTY.

Galvanizers

188 & 190 NORTH UNION ST., CHICAGO.

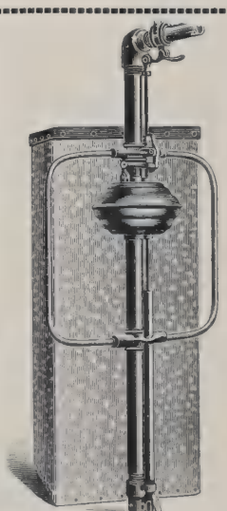
THE CANTON STEEL ROOFING CO.

.....MANUFACTURERS OF.....

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

Canton, Ohio.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.



A. H. PEIRCE MFG. CO.

S. W. Corner Kinzie and Green Streets,

CHICAGO

WE MANUFACTURE ALL THE GALVANIZED IRON APPLIANCES USED IN ICE MAKING AND REFRIGERATING PLANTS

HEREWITH WE APPEND EXTRACT FROM A LETTER FROM ONE OF OUR CUSTOMERS . . . . . .

OFFICE OF HERCULES IRON WORKS.

A. H. PEIRCE MFG. CO. CHICAGO, January 19, 1892.

Gentlemen: * * * For three years we have bought largely from you our supply of ice cans and other galvanized iron work used in our plants, with uniform satisfaction to ourselves and our customers, and cheerfully recommend you in this instance.
* * * *

HERCULES IRON WORKS.

ESTIMATES SUBMITTED. CORRESPONDENCE INVITED

ICE CANS, COLD STORAGE TANKS, BRINE PIPES, FILTERS, CONDENSERS, ETC.

IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD***, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

KEYSTONE CHEMICAL CO.

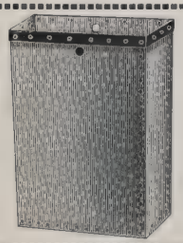
CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate

Yours truly,
CHAMPION ICE MFG. & COLD STORAGE CO.
(COPY) R. W. DUGAN, Sup't and Treas.

DUNLEVY SHEET IRON WORKS

Galvanized Iron . . **ICE CANS**



And all Sheet Iron Tank Work for ICE FACTORIES.
WRITE FOR ESTIMATES.

515 NORTH LEVEE, ST. LOUIS.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS. **ST. LOUIS, MO.**

WINGATE & MELL,

MANUFACTURERS OF : : : **ICE CANS**

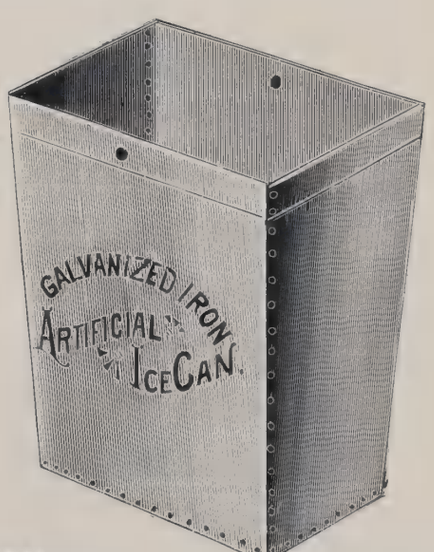
WRITE FOR ESTIMATES.

44 & 46 North Broad Street, **ATLANTA, GA.**

CAPACITY 300 PER DAY.



WRITE FOR PRICES



NEWBURGH, N. Y., November 29, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL,
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110 X 210 FT.

Established 1861. Incorporated 1890.

THE KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

WRITE FOR SAMPLES AND FULL PARTICULARS ON

BEST INSULATING MATERIAL



For ∴ COLD STORAGE WAREHOUSES, AND REFRIGERATOR CARS, ICE HOUSES, AND ALL REFRIGERATION

Extensively Used and Highly Endorsed by Experts.

NEPONSET WATER-PROOF FABRICS

F. W. BIRD & SON, SOLE MANUFACTURERS, East Walpole, Mass.

S. C. BARRETT MFG. CO., CHICAGO, Western Agents.

Mineral Wool

BEST INSULATOR FOR . . . . . ICE HOUSES, COLD STORAGE ROOMS, ETC.

REFERENCES ON APPLICATION.
SAMPLES FREE. . . . . U. S. MINERAL WOOL CO. 2 CORTLANDT ST., N. Y. CITY.

BIRD'S SHEATHING

ESPECIALLY PREPARED FOR USE IN REFRIGERATORS AND COLD STORAGE

THE ONLY WATERPROOF ... INSULATING PAPER That will not Deteriorate with Age.

SEND FOR SAMPLES AND PRICES.....

THE BIRD PAPER MFG. CO., 149 & 151 Church St. NEW YORK.

Insulating Linings

EVERY VARIETY FOR REFRIGERATORS, REFRIGERATOR CARS AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

P. & B. WATERPROOF INSULATING PAPERS . . .

TRADE P & B MARK REGISTERED

ARE THE BEST MADE.

They contain **no tar,** are **odorless** and **clean to handle,** made from the best of paper stock; used by the largest and most prominent cold storage and refrigerating plants in the **world.**

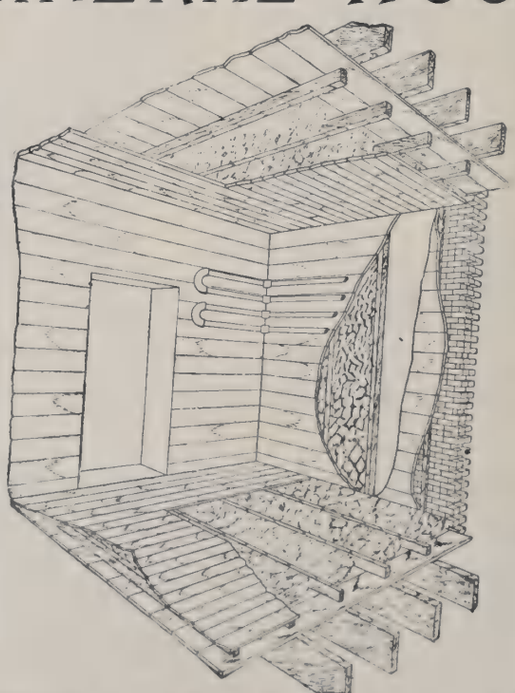
P. & B. PRESERVATIVE COMPOUNDS

For insulating **walls** and preserving all kinds of **iron** and **wood work** exposed to **dampness,** acids or alkalies. The material is very **penetrating,** always remains **elastic,** will not chip or peel off. We also manufacture a heavy waterproof canvas material thoroughly **saturated** with our P. & B. Preservative Compound. This Material is a perfect **insulator,** strong and very durable.

STANDARD PAINT CO., SOLE MANUFACTURERS, 2 LIBERTY STREET, NEW YORK.

MINERAL WOOL

COLD STORAGE, BREWERIES



INSULATION

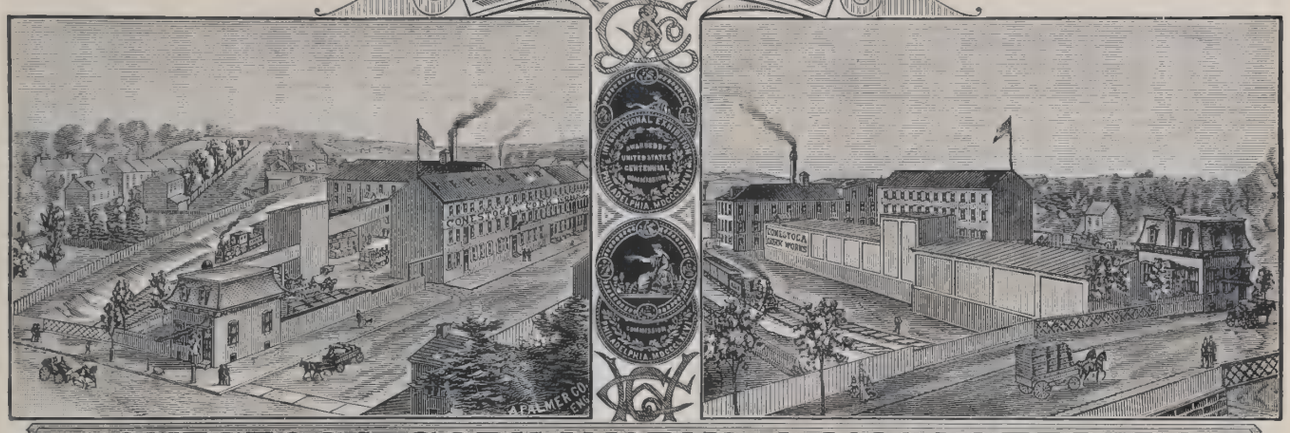
... ICE PLANTS & REFRIGERATORS. ...

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

ARNOLD & CO



CONESTOGA CORK WORKS, LANCASTER, PA.

NEW YORK SALESROOM, 67 MURRAY ST.

MANUFACTURERS OF ALL KINDS OF MACHINE CUT CORKS

Granulated Cork For Insulating Purposes

Our productions were awarded the First Premium at the Great Centennial for Uniformity and Quality. . . . .

GIVE US A TRIAL ORDER AND BE CONVINCED.

ADDRESS ALL COMMUNICATIONS TO . . . . . CONESTOGA CORK WORKS, OR TO ARNOLD & CO.

B. G. DODGE

MANUFACTURER OF EVERY DESCRIPTION OF MACHINE-CUT CORKS

FOR INSULATING PURPOSES A SPECIALTY

GRANULATED CORK



PROPRIETOR OF LANCASTER CORK WORKS

LANCASTER, PA.

ARMSTRONG, BRO. & CO.

INCORPORATED

MANUFACTURERS OF GRANULATED CORK FOR

INSULATING PURPOSES

THE MOST PERFECT AND DURABLE INSULATING MATERIAL KNOWN FOR FILLING ICE HOUSES, REFRIGERATORS, COLD STORAGES ETC.

ALSO MANUFACTURERS OF

MACHINE CUT CORKS COMPRESSED POPLAR BUNGS, PLUGS AND TAPS.

FOR PARTICULARS AND ESTIMATES ADDRESS

ARMSTRONG BROTHER & CO. INCORPORATED, PITTSBURGH, PA.
THE ARMSTRONG BROTHERS CO. NEW YORK.
FAY-ARMSTRONG CORK CO. CHICAGO.
ARMSTRONG-GILBERT CORK CO. ST. LOUIS.

Granulated Cork

FOR INSULATING PURPOSES

THE CLEANEST AND BEST IN THE MARKET.

Send for prices and samples.

DAVID KAHNWEILER, 146, 148 and 150 Worth Street, NEW YORK CITY.



Ice and Refrigerating Machinery

OILS

IAS. DALZELL & SON CO. PITTSBURGH, PA.

THE B. F. GOODRICH CO.

AKRON RUBBER WORKS, AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

HOSE OF HIGH QUALITY FOR ICE FACTORIES AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds, Belting, Valves, Etc.

SPECIALTIES TO ORDER. Samples and Prices upon Application.

GROUND CORK

FOR INSULATING PURPOSES.

Pure Cork Brought Boards, Refrigerator Cars, Brewers, and all insulating purposes. Large stock on hand which can be supplied at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non conductor of heat in all dry storage rooms and situations. They are FIRE-PROOF, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .



The "STEAM JACKET"
BOILS THE WATER.

WM. BARAGWANATH & SON,

48, 50 & 52 WEST DIVISION STREET,

CHICAGO.

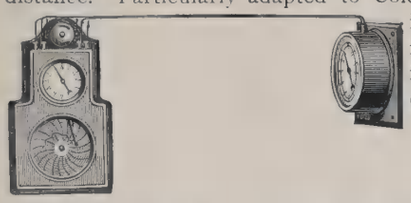
.....MANUFACTURERS OF.....

EXHAUST FEED WATER HEATERS
LIVE STEAM FEED WATER PURIFIERS
POWER PUMPS, ETC., ETC.

SEND FOR CIRCULARS.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.



FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

.....MANUFACTURER AND IMPORTER OF.....

THERMOMETERS
AND HYDROMETERS.

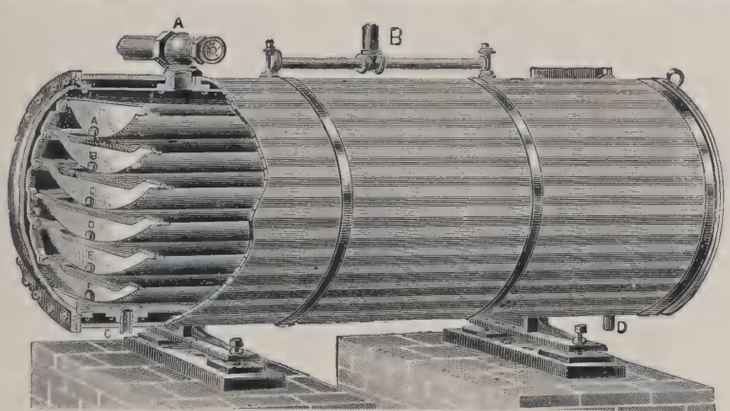
Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . .
CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.





HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

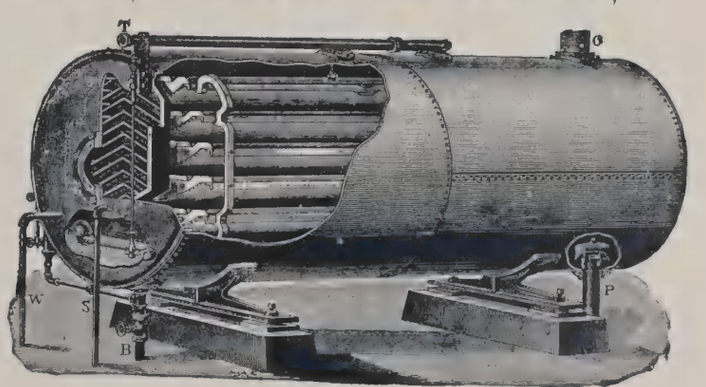
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

ROSENGARTEN & SONS,
PHILADELPHIA, PA.
Manufacturing Chemists
26° AQUA AMMONIA
FOR REFRIGERATING PURPOSES
MADE FROM SULPHATE OF AMMONIA ONLY.

PURE CRYSTAL ICE—NO CONE.
NO CANS
NO BRINE
NO PLATES
NO DISTILLING
New methods used. Cost Reduced. Direct Expansion System. Rapid Freezing. Harvested in Blocks of Standard Sizes by the Steam Ice Cutter. Can Plants changed to this system.
ADDRESS,
LEA PUSEY.
WILMINGTON, DEL.

THE CLEVELAND ANHYDROUS AMMONIA WORKS
THOS. FLESHER, JR., Proprietor.
MANUFACTURERS OF ...PURE... Anhydrous Ammonia.
70 E. Prospect St., CLEVELAND, OHIO.

ABSOLUTELY PURE LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA
HELLER, HIRSH & CO.
Furnished at short notice from the following branch offices, where we keep sufficient stocks constantly on hand:
240 North Front St. (Wm. Hoos, Ag't), Philadelphia, Pa.
65 Walnut Street (Wm. Bunkle, Agent), Cincinnati, O.
411 East Lombard Street, Baltimore, Md.
Brown's Wharf, Charleston, S. C.
10 Pacific Avenue, Chicago, Ill.
MAIN OFFICE, 164 FRONT STREET,
P. O. BOX 1753. NEW YORK.

Salt for Brine FOR Ice Making AND Refrigerating Machines
99½ per cent PURE SALT

If a brine is made from a salt containing lime, the lime is dissolved with the salt and held in solution by the brine; but when this brine is chilled to a low temperature, it will no longer hold the lime in solution, and it will be deposited and forms a coating of insulating substance on the inside of the pipes. This can be readily seen by examining the inside of any pipe that has been used in a brine made from an evaporated salt. This coating largely decreases the amount of heat that the cold brine is capable of drawing from the surrounding medium, and reduces the effectiveness of the plant by a considerable percentage. The cost of the extra power necessary to overcome the insulation of the coating of lime would many times pay the whole cost of a pure salt.

THE RETSOF No. 1 BRINE SALT
Is 99½ per cent chloride of sodium. It is readily dissolved, and from it a brine can be made that is practically chemically pure. This salt is used by the De La Vergne, Frick, Pictet, Arctic, Mayer, Harrisburg, and other Refrigerating Machine Companies for making the brine to start their machines.

THE RETSOF SALT MINES
Are located at RETSOF, in the central part of New York State, and from this point we have every facility for shipping in any direction. From our warehouses in *New York* and *Philadelphia*, and through our agents throughout the country, we can fill orders for less than car load quantities without delay or excessive retail prices.

FOR PRICES IN ANY QUANTITY, DELIVERED AT ANY POINT, APPLY TO
FOSTER, BROWN & CO.
. . . . 146 Broadway, NEW YORK.

THE STAR VENTILATOR
MADE OF GALVANIZED IRON, COPPER OR BRASS
Write for Prices and Discounts.


For ventilating Mills, Factories, Foundries, Breweries; also Churches, School Houses, Theatres, in fact *all kinds* of buildings, there is *none equal to the "STAR."*
A cheap Ventilator, which will not do the work required, is *costly at any price.* Our claim for *superiority* of the *"STAR" VENTILATOR* is based on *merit* only; we believe the *first cost* to be a *secondary consideration.*
GALVANIZED SHEET IRON Patent Leveled. Guaranteed Free from Buckles.
CORRUGATED IRON For Siding or Roofing. Galvanized and Painted. . .
MERCHANT & Co. PHILADELPHIA. NEW YORK. CHICAGO. KANSAS CITY. LONDON.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° **AQUA AMMONIA**

Containing 29 ¼ per cent of Ammonia. FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES

245 BROADWAY, NEW YORK.

WM. B. SEVERN. A. L. CAVEN.

SEVERN & CAVEN,

MANUFACTURERS OF

ABSOLUTELY PURE . . . . . **Liquid Anhydrous Ammonia**

MANUFACTURED FROM SULPHATE OF AMMONIA ONLY.

WORKS: WHITE HILL, N. J.

OFFICE: 48 N. Delaware Ave., PHILADELPHIA.

BALANCED VALVES



The accompanying cut represents a balanced valve which we manufacture, but it is not made to compete with other valves in price, because it is very heavy and well made. There is no lost motion in its parts, and the guide for the steam will be found of advantage. We also manufacture other steam regulating devices.

Mason Regulator Co.
BOSTON, MASS.

ATTENTION

ICE MACHINE MAKERS, BREWERS AND EVERYBODY INTERESTED IN . . . .

FILTRATION OF WATER

SHOULD KNOW THAT



THE ONLY
Perfect Water Filter.

THE LOOMIS
Improved Water Filter

IS THE ONLY WATER FILTER WHICH CAN PERFECTLY CLEANSE ITSELF.

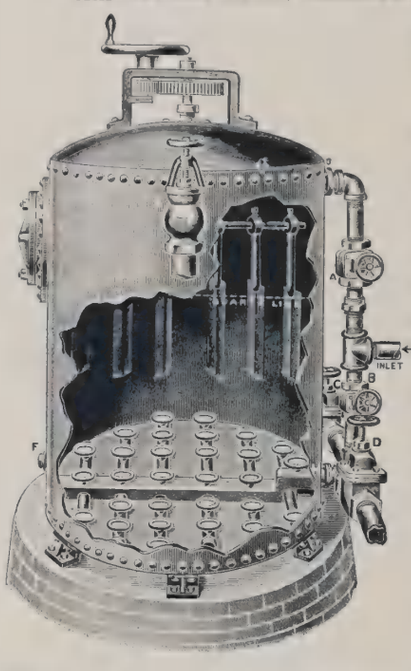
The Loomis Improved Filter Co.
43 S. Holliday Street, BALTIMORE.

New York Office, 111 Broadway, Trinity Building.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST.,
CHICAGO.

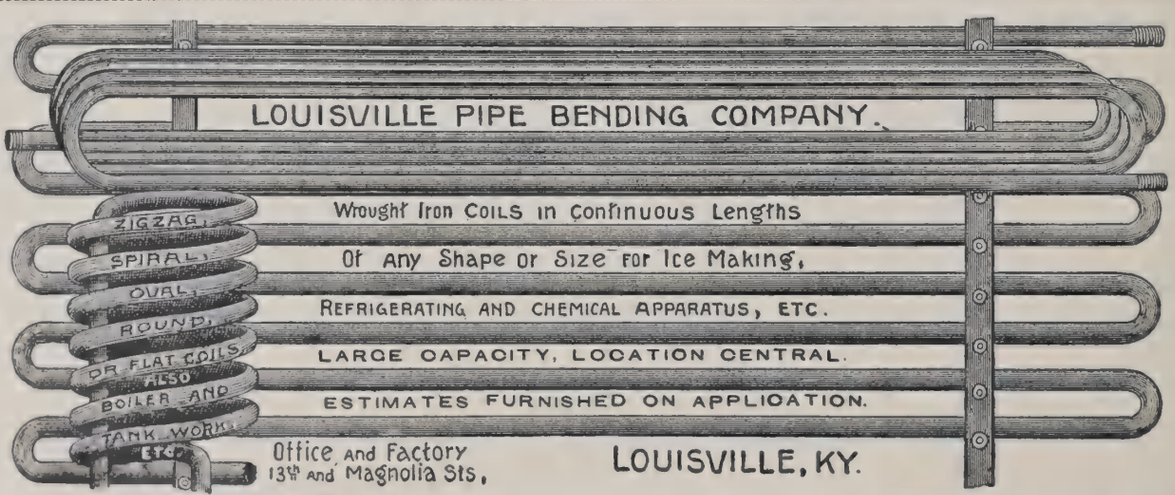
REFER BY PERMISSION TO
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.



Important
TO ICE FACTORIES.

By using our system, live steam is no longer required to make up the deficiency of exhaust steam, thus a great saving in coal, wear and tear on boilers and engines.

ABUNDANCE OF WATER WITHOUT COLOR.

We make a specialty of purifying water **WITHOUT AID OF CHEMICALS** in any form whatever.

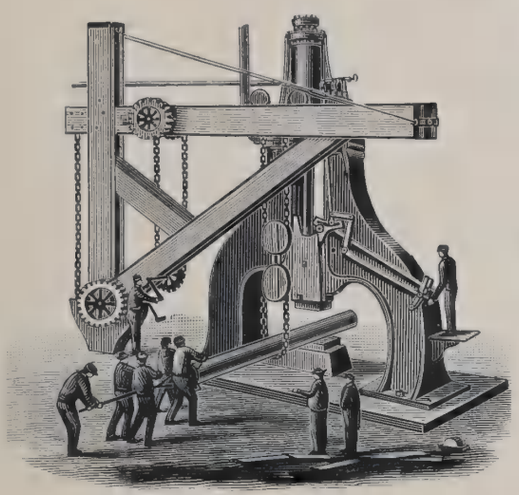


The only system that eliminates silicate, iron, bacteria, and all matter in physical solution, and is a perfect deodorizer and decolorizer. Not an improvement on any now in existence, but a distinct purifying system in itself, with no competitors.

For Particulars, References and Estimates, address

Bühring
Water Purifying Co.
1389 BROADWAY,
NEW YORK.

PIPE WELDING BY ELECTRICITY



These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.

THE SAMSON STEAM FORGE Co.

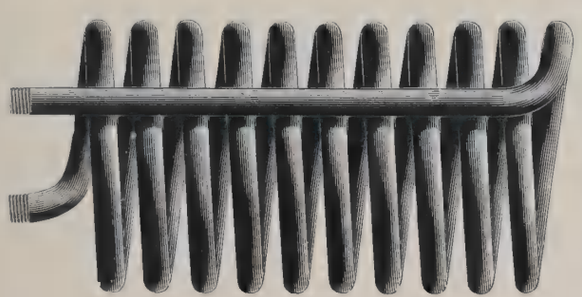
OFFICE AND WORKS, CORNER Sacramento and Carroll Aves., CHICAGO.

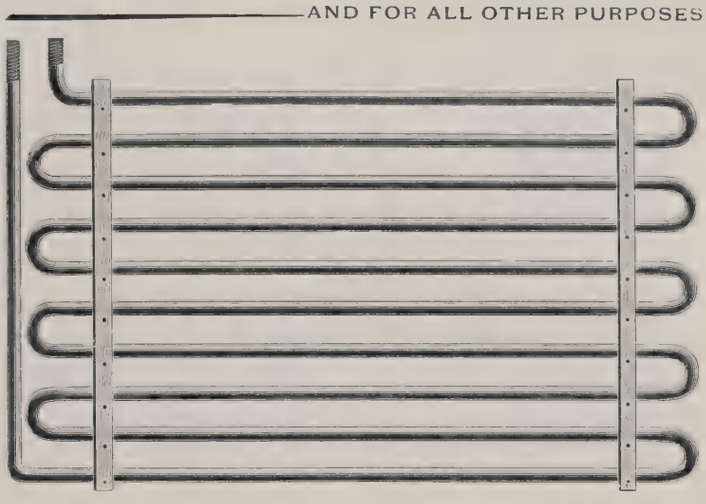
MANUFACTURERS OF

WROUGHT IRON COILS

FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES



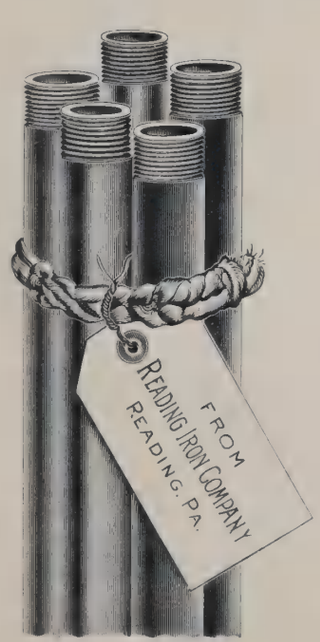


READING IRON COMPANY

.....MANUFACTURERS OF.....

WROUGHT IRON PIPE, CHARCOAL IRON BOILER TUBES, AND OIL WELL TUBING AND CASING . . . . . .

SPECIAL Coiling and Ammonia Pipe FOR Ice AND Refrigerating Machines



Our Standard and Extra Heavy Pipe for bending and coiling purposes is being used largely by builders of Ice and Refrigerating Machines with unvarying success. We are also equipped for making Coils and Bends, Ammonia Valves and Fittings, Boilers, Tanks, Still and Absorbers.

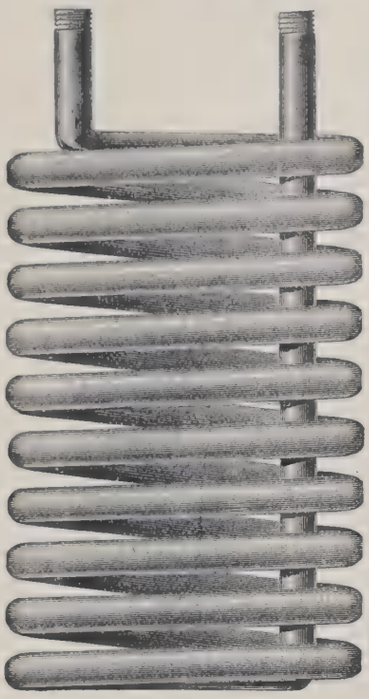
Having had a large experience as builders of various types of Refrigerating Machinery, we are prepared to successfully construct this class of work.

WE ALSO MAKE

IRON AND STEEL FORGINGS OF ALL DESCRIPTIONS.

W. T. HILDRUP, Jr., M. E., Sec'y & Treas. J. HERVEY PATTON, Chairman. D. E. TRACY, M. E., Sup't.

THE HARRISBURG PIPE BENDING CO. LIMITED.



OFFICE, N. E. COR. HERR ST. AND PENNSYLVANIA R. R.

HARRISBURG, PA.

P. O. BOX 603.

MANUFACTURERS OF

COILS AND BENDS

Of Wrought Iron Pipe

IN ROUND, OVAL, ZIG-ZAG, SPIRAL, HELICAL, AND TAPERING FORMS,

For Ice Making and Refrigerating

COILS OF ANY REQUIRED LENGTH, AND OF LARGE SIZES OF PIPE.

Prompt Delivery Assured

IRREGULAR PIPE BENDING A SPECIALTY.



AMMONIA BOTTLE.

AMMONIA BOTTLES OR FLASKS WITH WELDED HEADS

STRAIGHT OR CONCAVE

WROUGHT IRON ANHYDROUS AMMONIA BOTTLE COCKS ANY DESIRED PATTERN.

TANK DEPARTMENT

Stills and Absorbers

FOR ABSORPTION AMMONIA ICE MACHINES . . . .

BRINE AND CONDENSER TANKS

ALL SIZES

Sectional Tanks

A SPECIALTY.

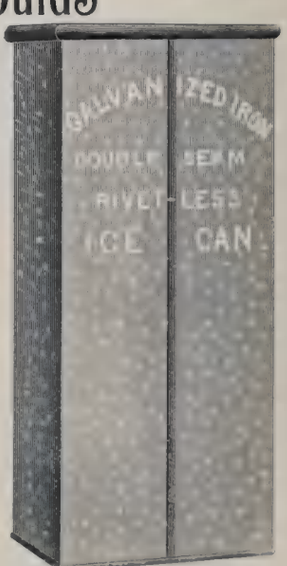
These Tanks are made in flat sections, can be erected by unskilled labor, and are perfectly tight.

SPECIAL ATTENTION GIVEN TO REPAIRS AND REMODELING OF EXISTING ICE MACHINES.

ICE CAN DEPARTMENT

Galvanized Iron Ice Cans or Moulds

OF ANY SIZE, WEIGHT OR PATTERN.

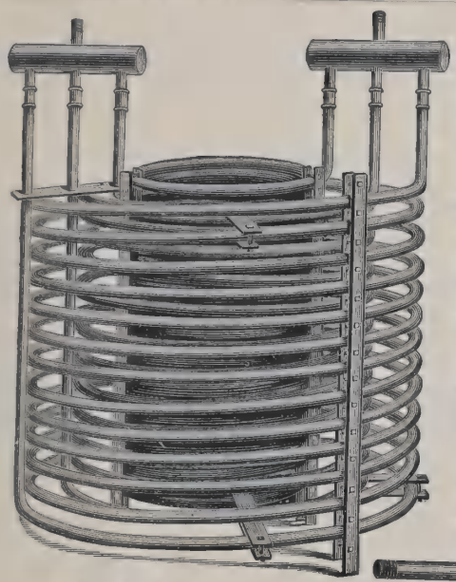


Our Double Seam, Rivet-less Can has no rivets to catch the ice, which is freed from the can with less waste than any other style of Can in the market. . . . .

FLUSH BOTTOMS,
NO AIR POCKET TO FLOAT
CANS IN THE BRINE TANK.

EVERY CAN TESTED AND WARRANTED TIGHT.

THE HARRISBURG PIPE BENDING CO. LIMITED.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

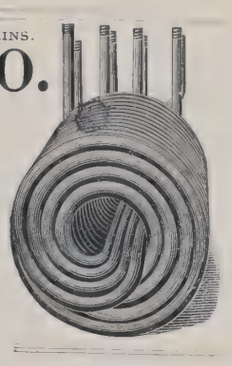
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

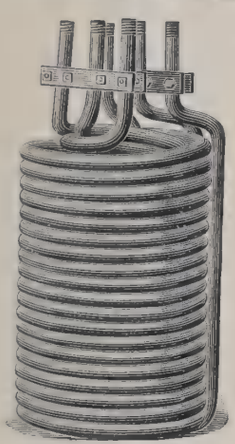
CATALOGUE AND PRICES ON APPLICATION.



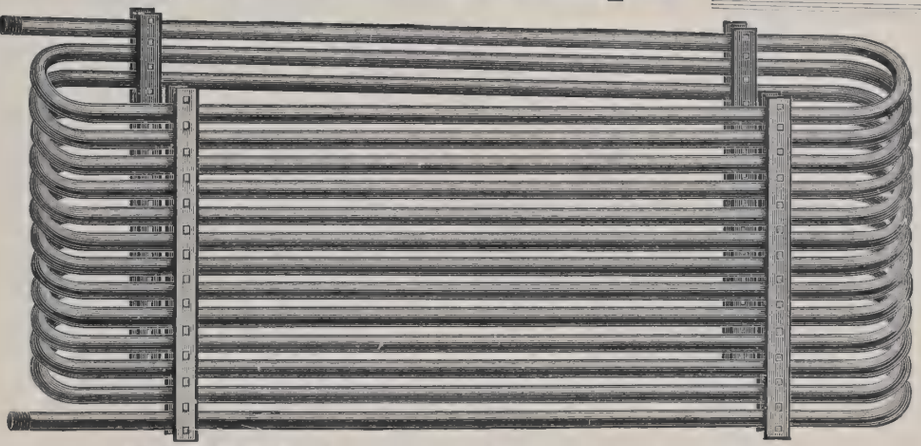
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.

THE ELECTRIC PIPE BENDING COMPANY

OF

HARRISON, N. J.

ARE NOW PREPARED TO FILL ORDERS FOR

SPIRAL COILS,
ZIG-ZAGS, OVALS,
IRREGULAR SHAPES
OF ANY SIZE AND LENGTH

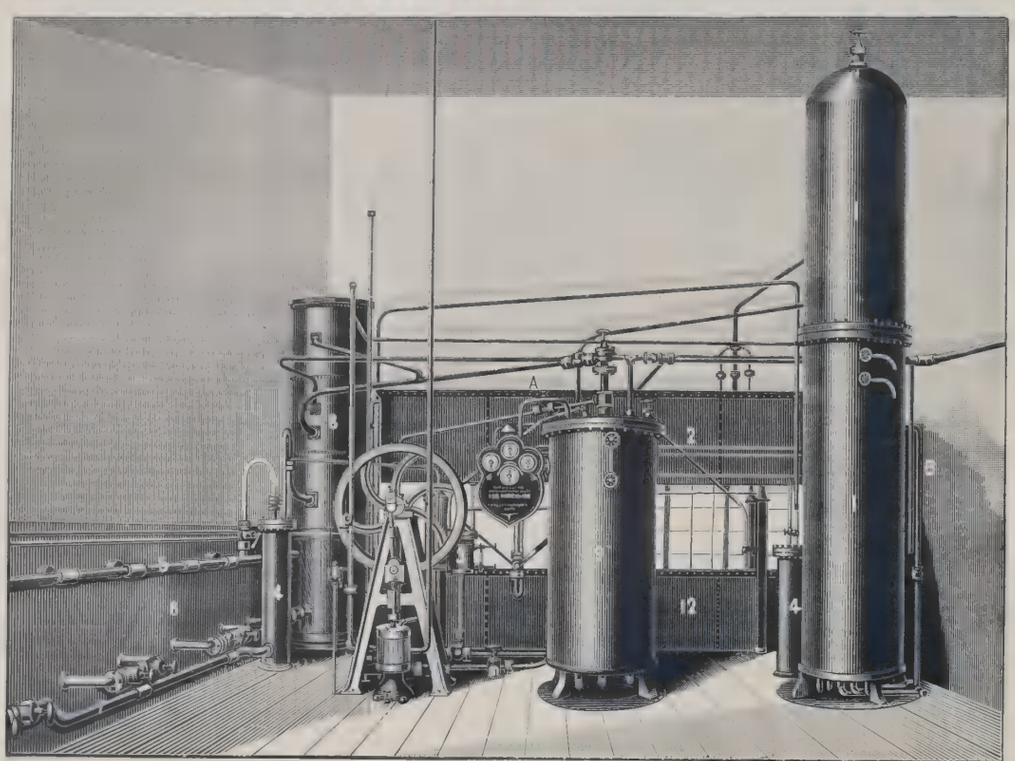
The work is done by the THOMSON ELECTRIC WELDING AND HEATING PROCESSES, thus giving greatly superior results to any of the old methods.

No injury from over-heating. Welds and Bends as sound as the rest of the pipe. All work promptly executed and guaranteed.

NO BURNT OR
DEFECTIVE WELDS.
NO SCALE.

ADDRESS **ELECTRIC PIPE BENDING COMPANY,**
HARRISON, N. J.

COLUMBUS IRON WORKS IMPROVED Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.
Established 1853.
Incorporated 1856.
W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

FARRELL & REMPE,

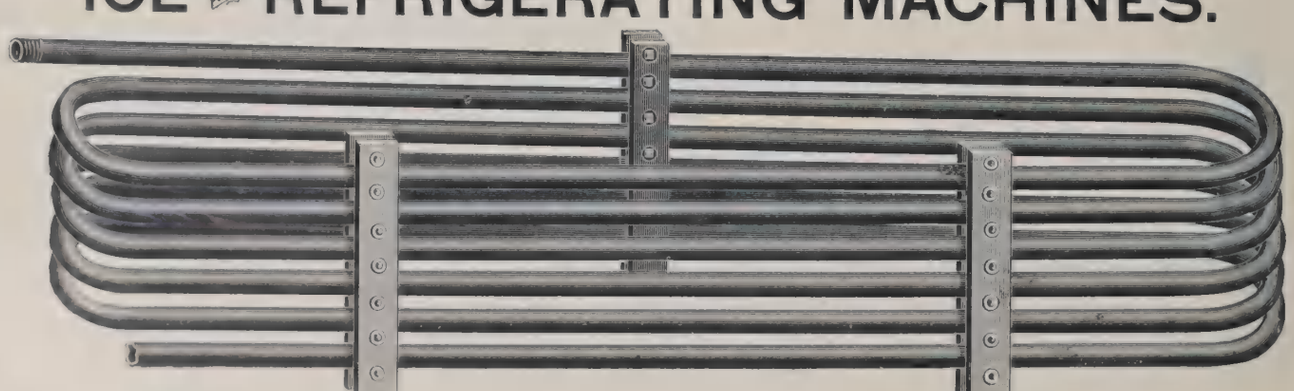
799, 801, 803 & 805 Ogden Avenue, corner Campbell Avenue, Chicago, Ill.

MANUFACTURERS OF

WROUGHT IRON COILS

—FOR—

ICE AND REFRIGERATING MACHINES.



All Ammonia Coils made of the very finest quality of Pipe (in any desired continuous length) and Tested to 400 lbs. Air Pressure.
Coils of all Descriptions for Heaters, Soap Makers, Blast Furnaces, Etc.

PIPE BENDING OF ALL KINDS A SPECIALTY.

PRICES FURNISHED ON APPLICATION.
General Eastern Agents, DIENST & LINCK, 32 & 34 Ferry Street, NEW YORK.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS,

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

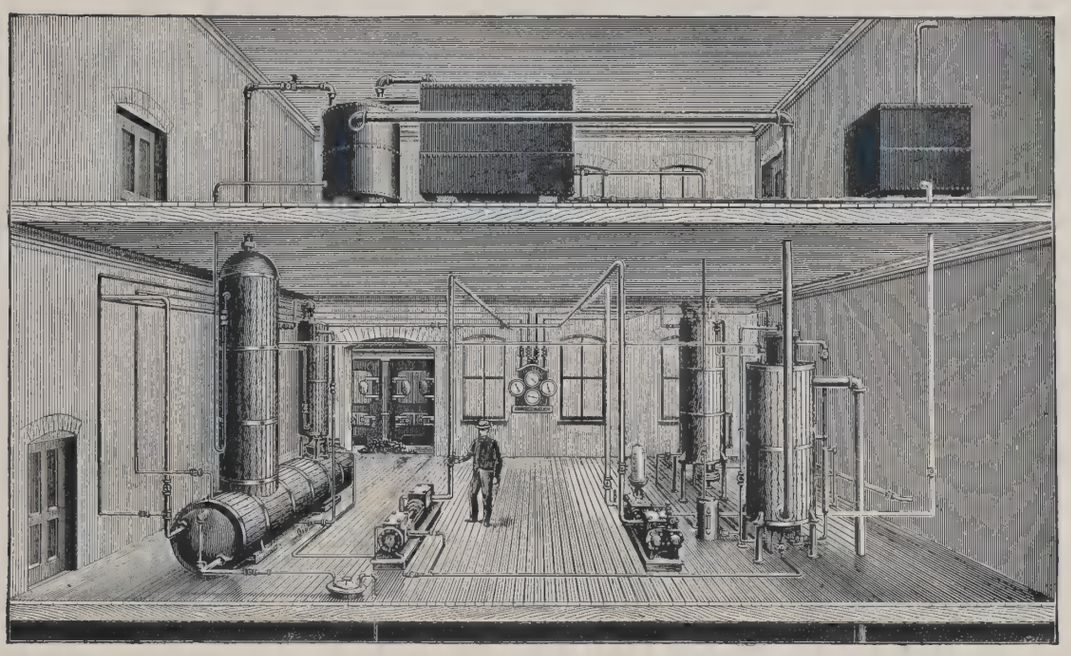
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



ISBELL-PORTER COMPANY, BUILDERS,

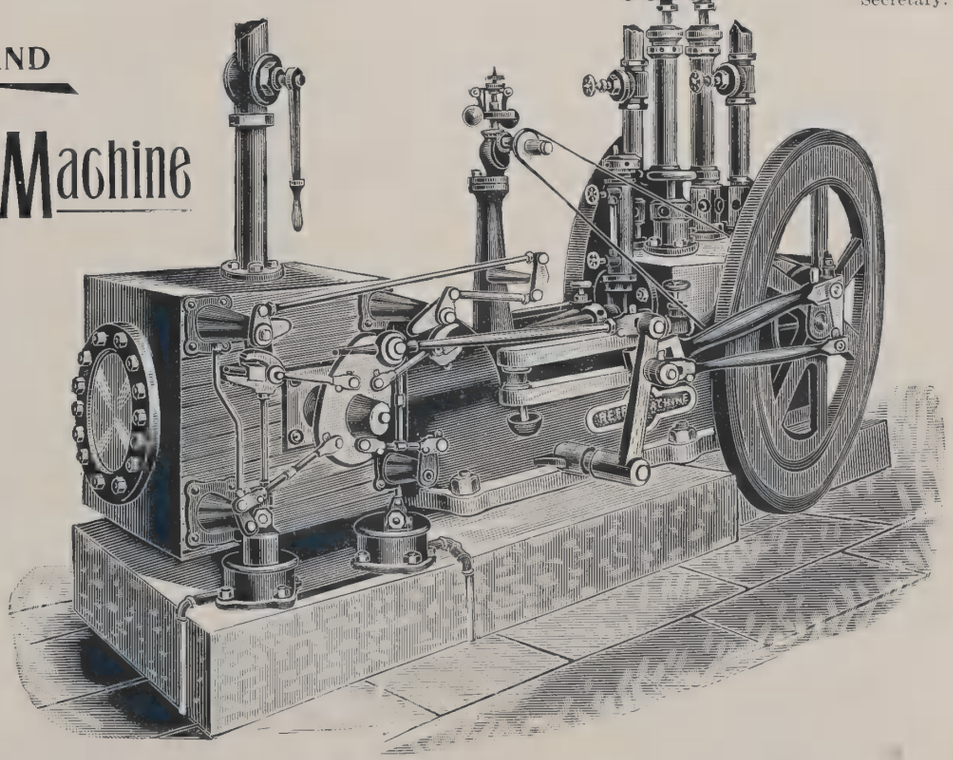
OFFICES

245 BROADWAY, NEW YORK 46 BRIDGE STREET, NEWARK, N J.

THE KRAUSCH IMPROVED STANDARD

THEO. KRAUSCH, President.
JOHN KRAUSCH, Secretary.

ICE AND Refrigeration Machine



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops, Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems (Refrigerant, Aqua Ammonia) as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK.

OR

THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

HAVING THE MOST RECENT AND DESIRABLE IMPROVEMENTS.

This machine has command of the absorption of the return gas from ice making tank to the ***fullest extent.*** The temperature of the absorber may fluctuate between 50 and 110 deg. Fahr. without affecting the freezing operations. We depend upon ***SURFACE IN THE ABSORBER.*** None others have it. 6,000 square feet of surfaces to which the gas has access on both sides. Should an increased output of ice be wanted in hot weather, an increase of heat through the retort will produce more ammonia gas. More pressure will condense it faster with the same water. A slight increase of the gas into the expansion coils makes ***more ice.*** More gas is readily taken up by our absorber in a given time. ***Absolute command*** of its speed of absorption. A large portion of the liberated heat due to the absorption is returned to the retort, ***thus saving fuel.*** No leaky tubes possible; none used. Objections ***heretofore held*** against ordinary absorption machines, ***does not hold*** against this machine. It is ***radically different, DECIDEDLY SUPERIOR, more simple. High temperatures not used.*** We can use exhaust steam from Corliss engines, and make ice with the "Plate" or the "Block" systems of freezing, for which we have the agency. Not possible with other machines. 500 lbs. to 50 tons capacity. ***Quality and quantity guaranteed.*** Circulars and estimates.

THE CASE REFRIGERATING MACHINE CO.

BUILDERS OF . . . ICE AND

Refrigerating

..MACHINES..

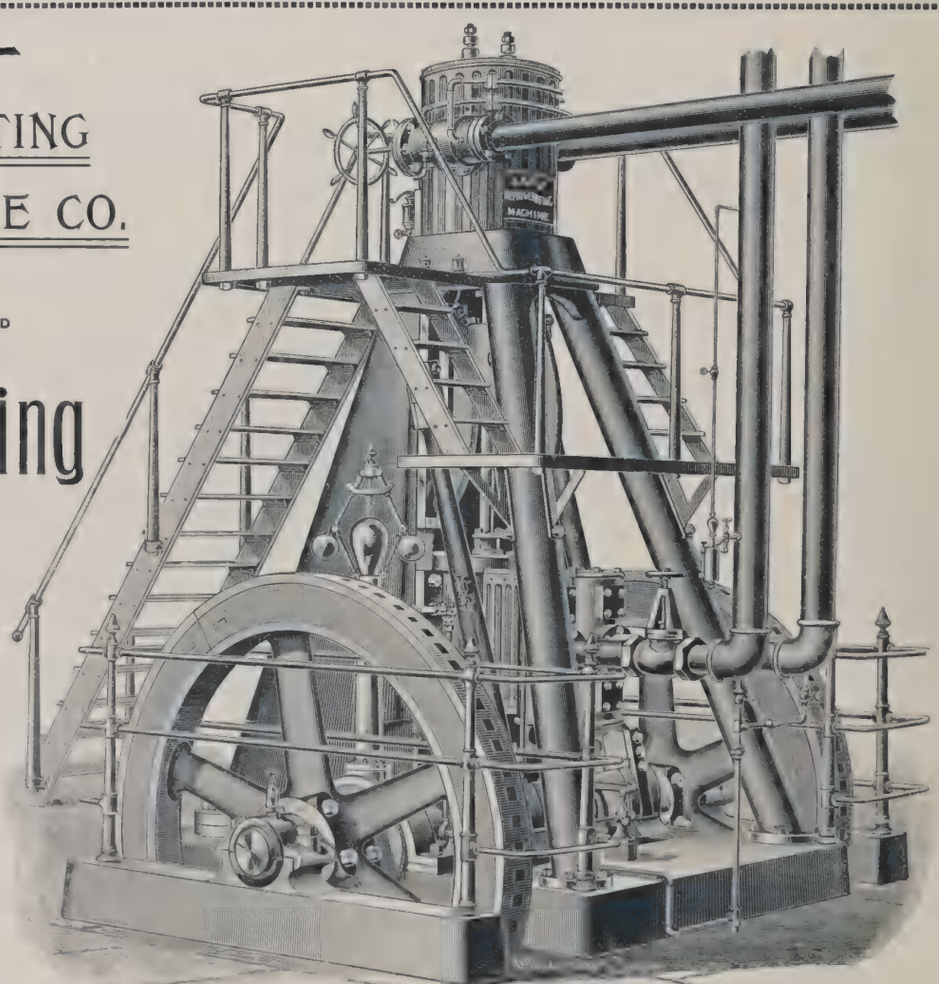
FOR ICE MAKING AND ARTIFICIAL REFRIGERATING

Full particulars, Estimates, Illustrated Catalogue containing list of machines in use, etc., furnished upon application.

We refer to the list of contracts taken by us since Oct. 1, 1891.

German-American Brg. Co., Buffalo, N. Y., one 65-ton machine.
Jos. Lauer Brg. Co., Binghamton, N. Y., two 20-ton machines.
Emlenton Producers Oil Co., Emlenton, Pa., one 20-ton machine.

BUFFALO, N. Y.



JOHNSON,

McCARTHY

& JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

ICE & REFRIGERATING MACHINES . . . . . .

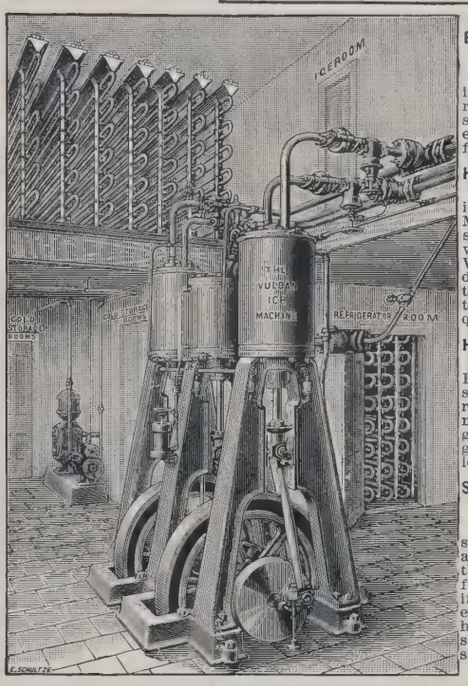
Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and . . . . .

Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect"

Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1888, has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

135-145 Fremont Street, SAN FRANCISCO, CAL.

Pennsylvania Iron Works Company

50th STREET AND MERION AVENUE,

PHILADELPHIA, PA.

BUILDERS OF.....

Ice Making and . . . Refrigeration Plants

Philadelphia, Dec. 29, 1891.

WE beg to announce to the public that we have concluded the purchase, from the estate of the late David Boyle, of Chicago, of the entire ICE MAKING business lately conducted by him. Being placed in possession of all drawings, patterns, etc., conversant with this line of business, and operating a large and completely equipped plant, we are prepared to execute promptly all orders for repairs, make any extensions or additions to the plants already erected, as well as to furnish estimates and plans to those contemplating the purchase of an Ice Making or Refrigerating Plant of any size.

Trusting that we may have the pleasure of being of service to you, and soliciting your commands, we are,

Very truly yours,

PENNSYLVANIA IRON WORKS CO.

New York Offices, 9 & 11 Wall St.

THE CRAFT

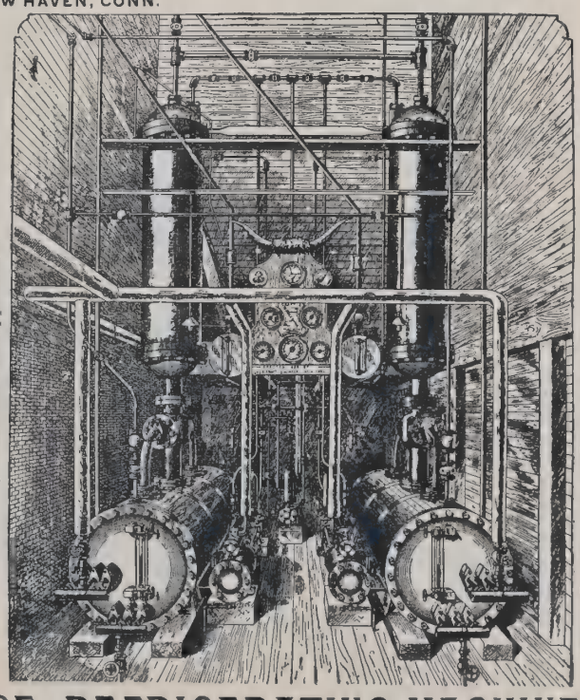
REFRIGERATING MACHINE CO.

JAMES B. CRAFT, Prest.
F. L. BIGELOW, Vice-Prest.
GEORGE S. BARNUM, Sec. & Treas.

No. 15 Cortlandt Street, NEW YORK,

WORKS: NEW HAVEN, CONN.

....MANUFACTURERS OF....



Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.

Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

ICE AND REFRIGERATING MACHINES

FOR ICE MAKING PLANTS.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

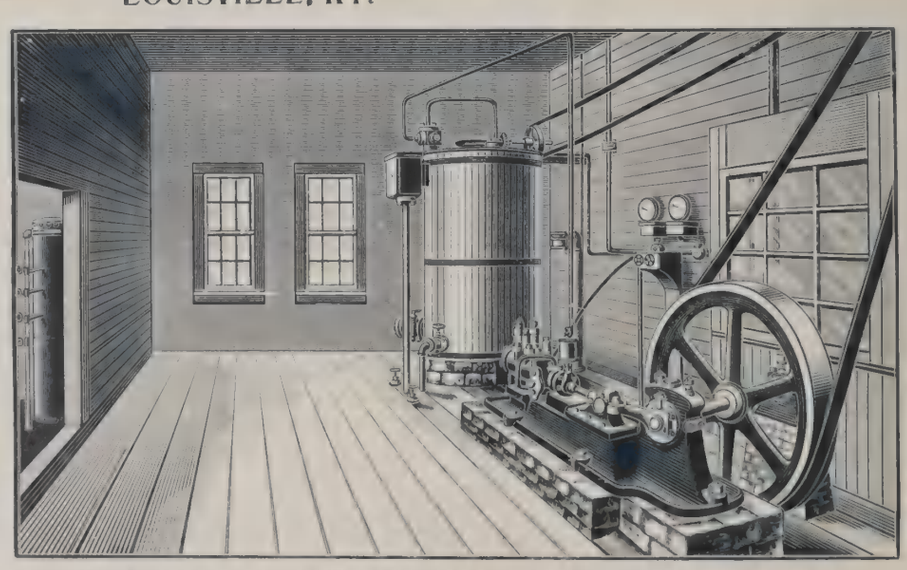
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



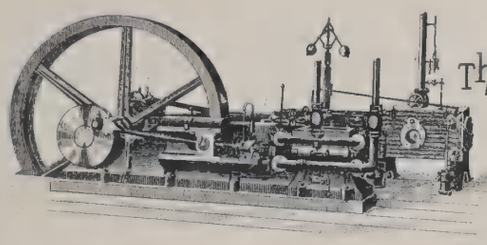
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy & Treas



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES,
CONFECTIONERIES,
COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING
..AUTOMATIC..
ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

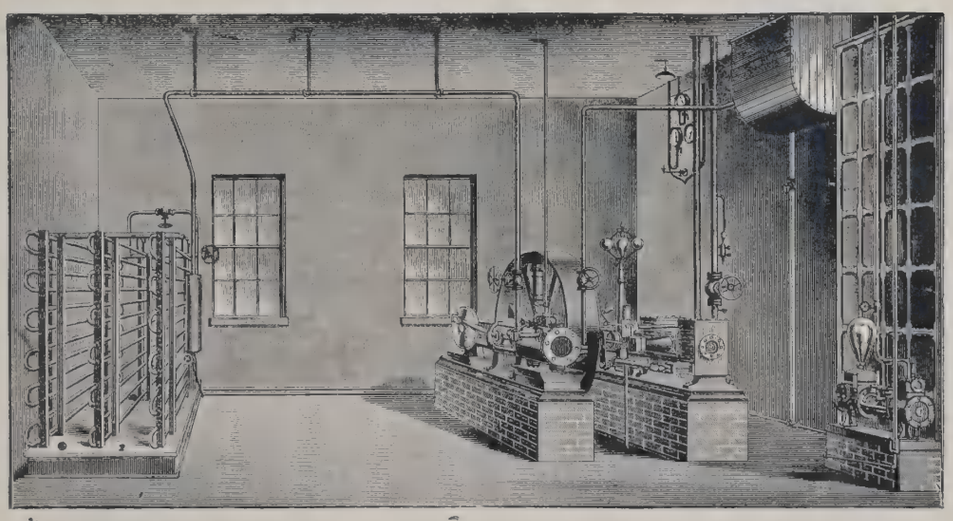
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The . American . Ice . Machine . Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND
ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability, ...
Efficiency, ...
Economy. . . . . .

ICE-MAKING OR
REFRIGERATING
PLANTS

From One Ton to Two Hundred
Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction. Every part is simple and complete,** is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

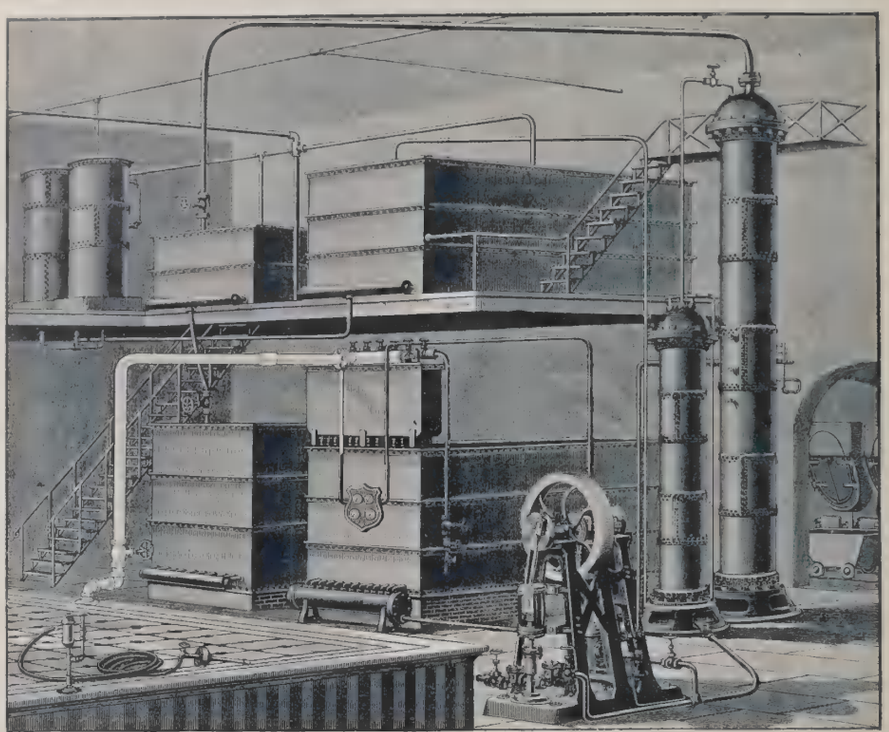
6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

Blymyer Ice Machine Company

CINCINNATI OHIO . . . . .

THE ***ABSORPTION MACHINE*** made by the Blymyer Ice Machine Co. is superior to any compression machine, either for refrigerating or ice making. These machines are ***radically different*** from all other absorption machines, and are in every way superior to them.



BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co.(2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co.	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co.	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston.	West Point, Miss.
1	3 "	DeCoppet Ice Co	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington, W.Va.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld.Stor.&Ice.Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co.(2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
*1	15 Ton.	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co.(4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg.&Cd.Sto.Co.(2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
**1	8 "	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co.	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs,Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

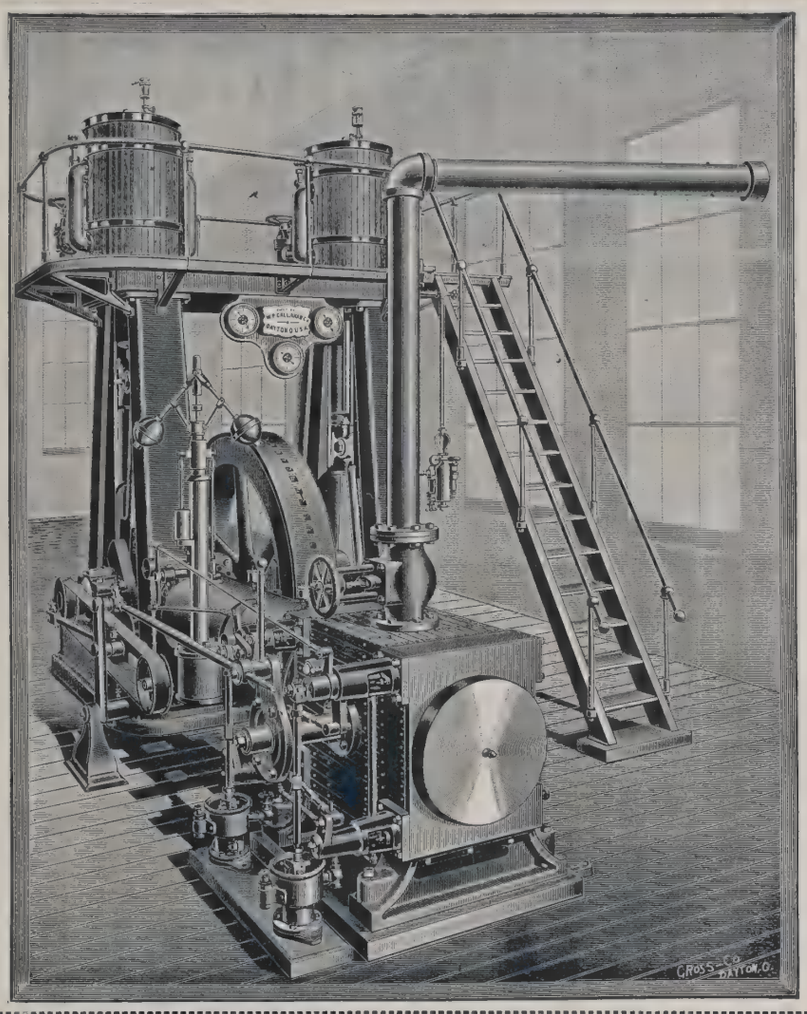
* These machines were erected in 1890.
** These machines were erected in season 1891.



BLYMYER REFRIGERATING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	Address.
	Ton		
2	50	Louisiana Brewing Co.	New Orleans.
1	40	Toledo Br'g & Malt'g Co.	Toledo.
1	40	Hudepohl & Kotte (Brew'y	Cincinnati.
1	50	Savannah Brewing Co.	Savannah.
1	25	Schantz & Schwind (Br'y	Dayton
1	15	John Smith's Sons (Brew'y)	Youngstown.
1	12	Christ Diehl (Brewery)	Defiance.
1	12	Genessee Oil Works.	Buffalo.
1	12	S. Davis, Jr., & Co. (Pack'rs)	Cincinnati.
1	50	Occidental Packing & Provision Co.	Lincoln.
1	15	Thos. McFadden, Jr. Cd. St.	Pittsburgh.
1	15	Grocers' Supply Co. Cd. Sto.	Pittsburgh.
*1	40	Adolph Coors (Golden Br'y	Golden.
*1	20	F. Conrad (Brewery	Anaheim.
*1	25	The Sachs-Prudens Ale Co.	Dayton.

* These machines were erected in 1890.



CUT OF . . . . . .
FIFTY TON REFRIGERATING
AND . . . . . .
THIRTY TON ICE MAKING
MACHINE, BUILT BY

W. P. CALLAHAN & CO.

BUILDERS OF

Ice Making AND Refrigerating Machinery

UNDER M. DENNEDY'S PATENT.

DAYTON, OHIO, U. S. A.

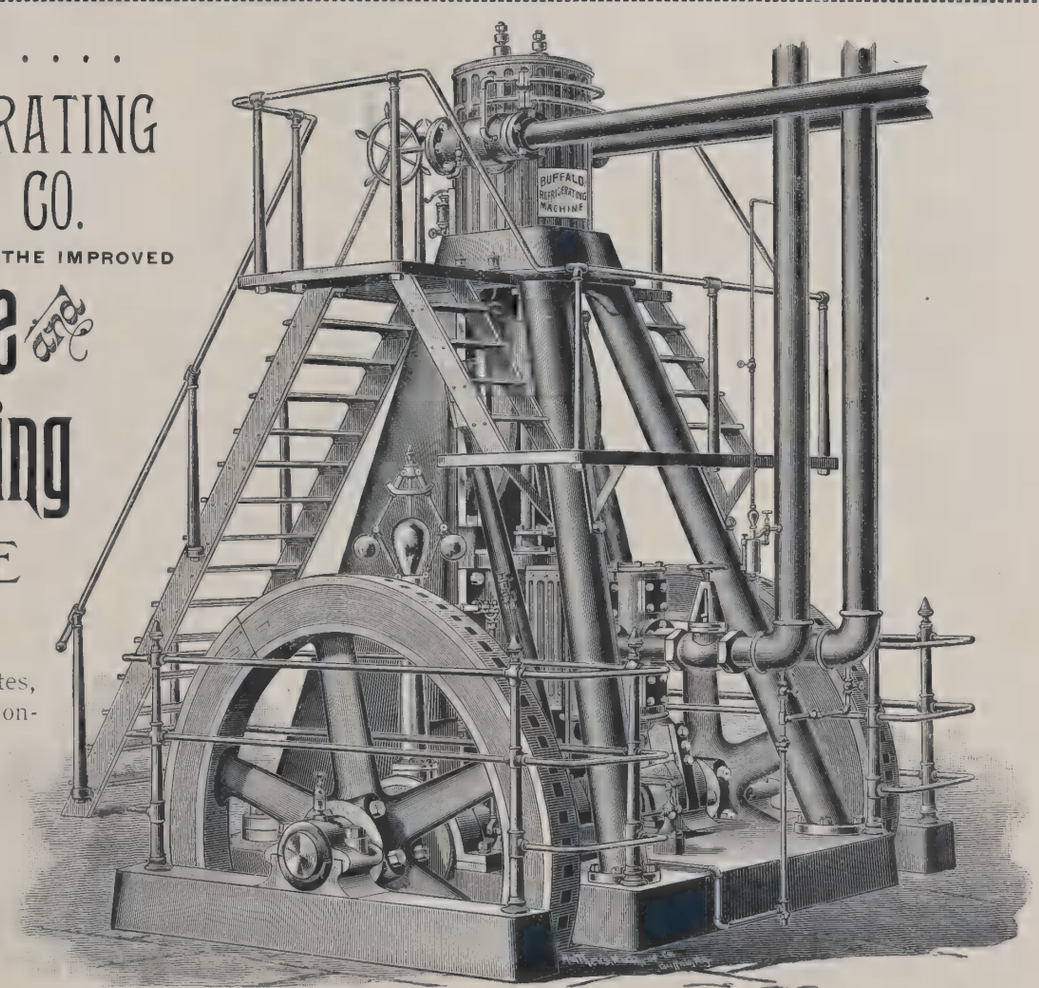
BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE

Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.



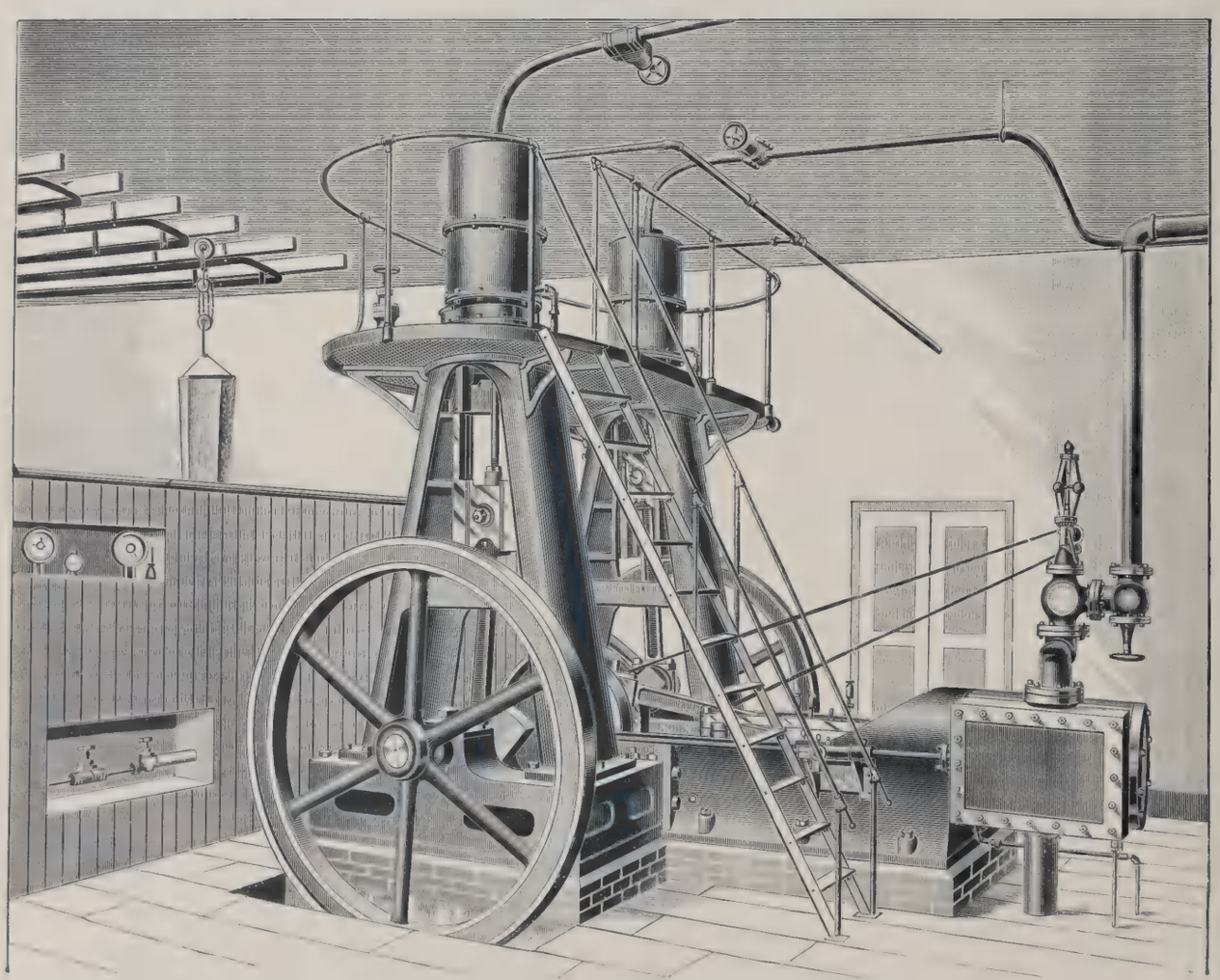
ICE MAKING MACHINERY

E. C. HILLYER & CO.

MANUFACTURERS OF

Improved Ice Making Machinery AND Refrigerating Apparatus

UNDER THE JOHNSON PATENTS.



VESSEL AND STEAMSHIP PLANTS

THE SIMPLEST AND MOST EFFECTIVE ICE MAKING MACHINERY ON THE MARKET

All working parts made to gauge and template, so as to be readily duplicated. Correspondence solicited. Testimonials from parties using our machines on application. We build our own machinery, and therefore can guarantee everything fully. Our machine will in every case make the amount of ice guaranteed. Send for our pamphlet: "HOW TO MAKE AN ICE FACTORY PAY."

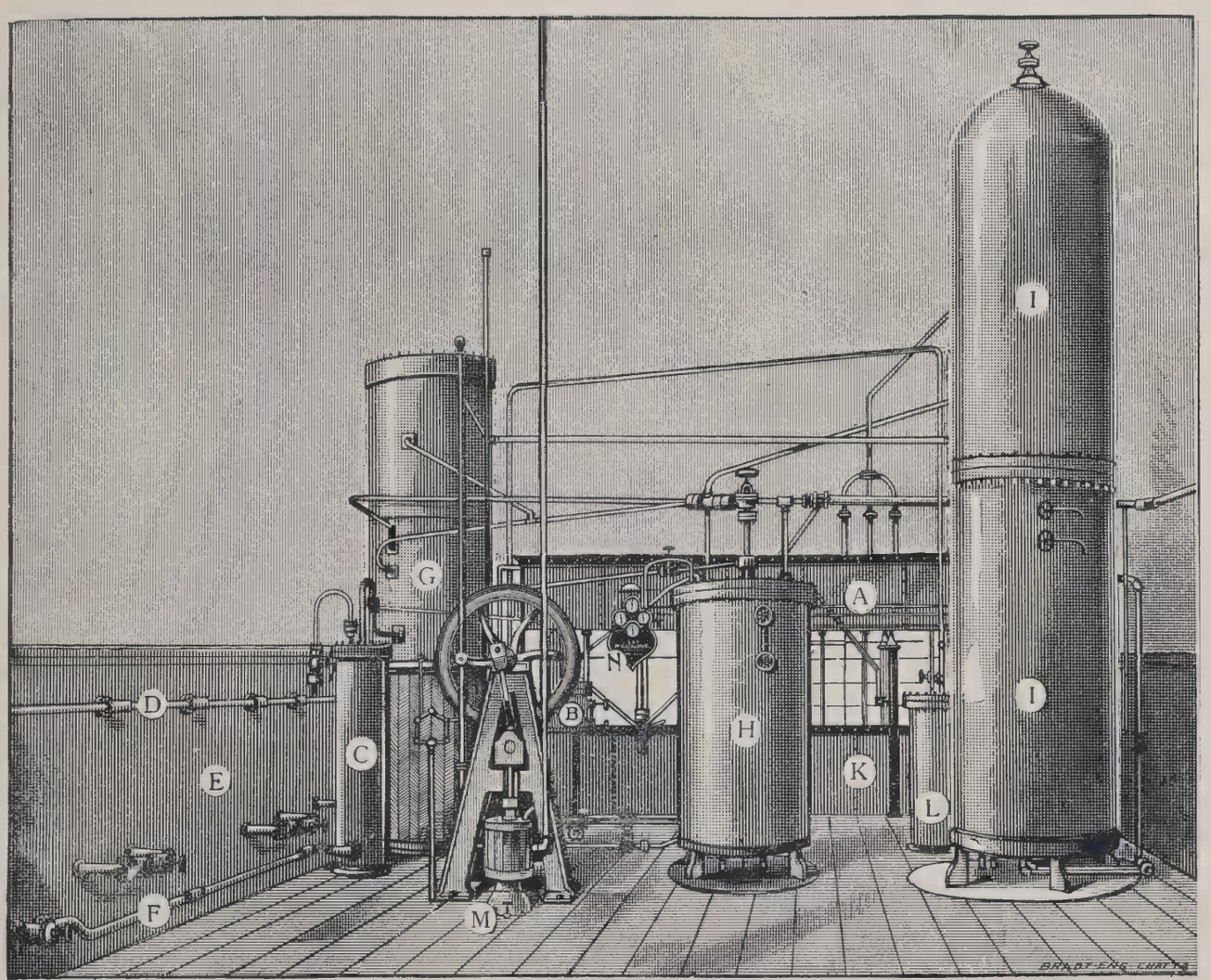
Office and Works, **NEWPORT NEWS, VA.**

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

. . . The Latest Improved Absorption . . .

ICE AND REFRIGERATING MACHINE.



.·. THE SOUTHERN .·.

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

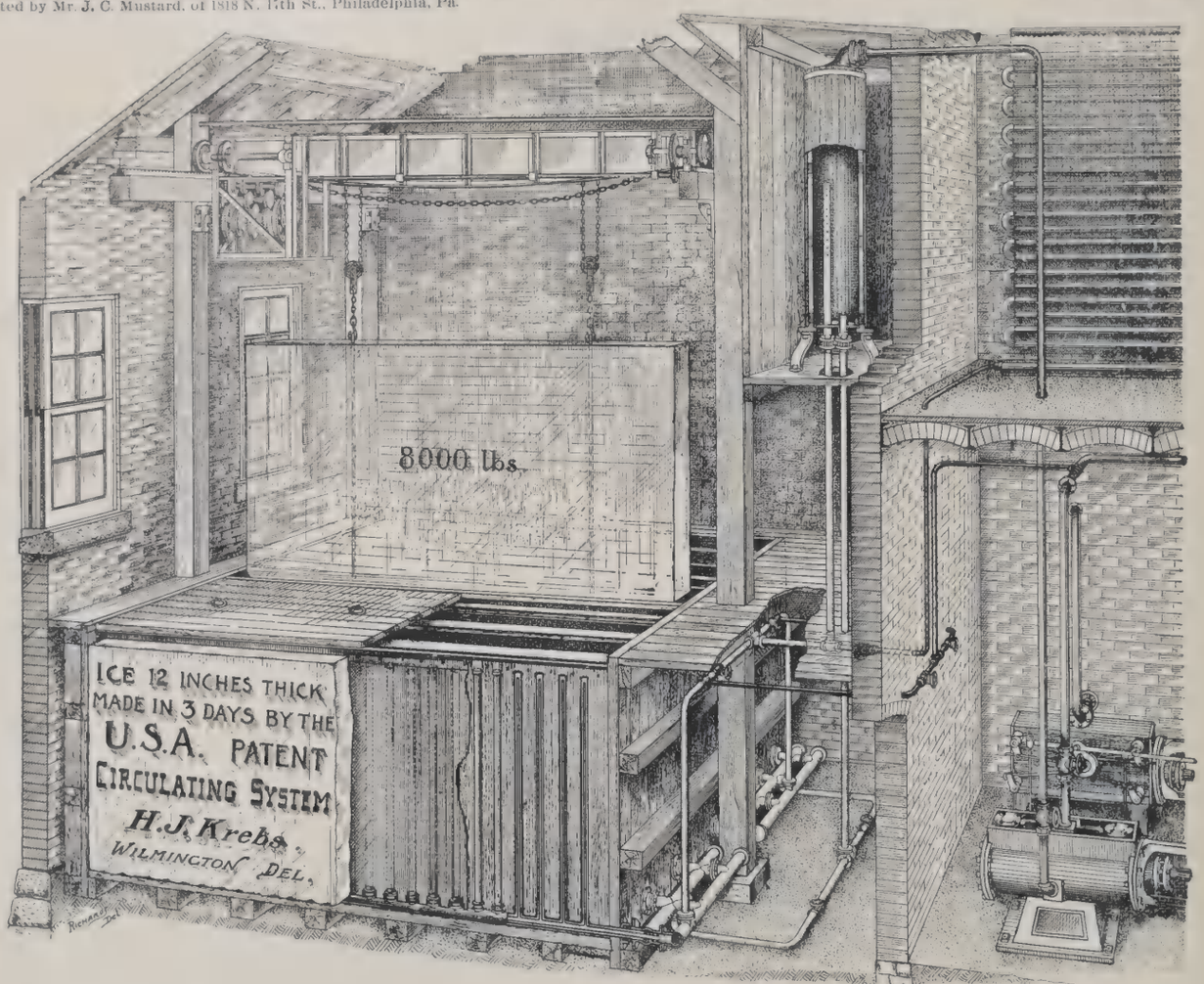
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.; Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING & REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Auttle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory,	Norfolk, Va.	Suffolk Ice Co.,	Suffolk, Va

The last name I plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

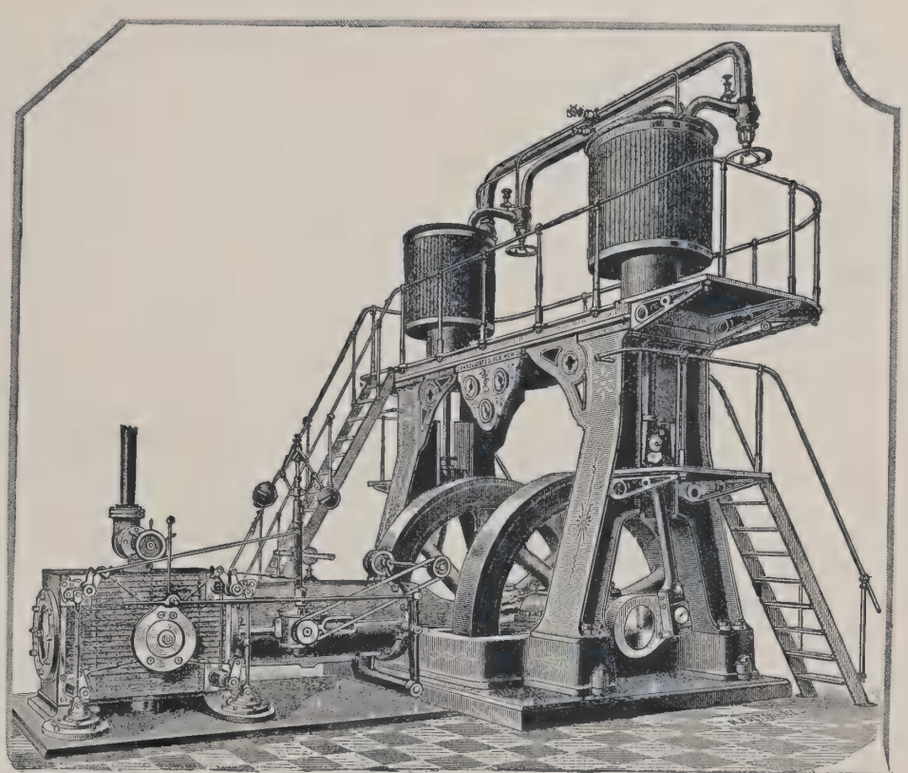
J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

CORRESPONDENCE SOLICITED.



CONSOLIDATED ICE MACHINES



FOR several years past we have been engaged in building Consolidated Ice Machines, and many of the very best running in the United States, at the present time, are of our manufacture. Since the original Company have failed, we have concluded to continue this business, and hereafter will manufacture, to order, any kind or style of a Consolidated Ice Machine desired. We will also contract for complete plants, and will put in either direct or brine circulation, as may be desired. We make a specialty of furnishing duplicate parts, and keep them always in stock, and can furnish on short orders any detail of these machines. We manufacture special steel valves and white metal rings designed especially for ammonia work.

We guarantee protection against any and all claims or pretended claims for patents on these machines.

These machines are known throughout the United States for the excellence of their construction, and their superiority to all others in use. They need no better recommendation than their own work. All the material and workmanship on them is of the finest quality. We have the original drawings and patterns in our possession, and can furnish a better machine for less money than can be built elsewhere. We also manufacture and keep on hand to supply the trade the finest steel fittings and steel valves made in the world, designed especially for ammonia work, and will be pleased to quote prices to purchasers.

NOTE.—It has come to our knowledge that parties owning or claiming to own a bogus patent, issued to one James Boyle in 1876, for an ammonia compressor, have been putting in circulation notices that the pumps used on the Consolidated Refrigerating Machines is an infringement on said patent, and that they will bring suit against any one using them; therefore we hereby guarantee to all persons purchasing one of our machines protection against said fraudulent claims, and request all persons receiving one of such notices to forward the same to us, with a statement setting forth whether they have been influenced not to buy a Consolidated Machine thereby. We also give the parties setting up these claims public notice that we will bring suit against them for damage to our business by them, by misrepresentation and fraud.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF ICE

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

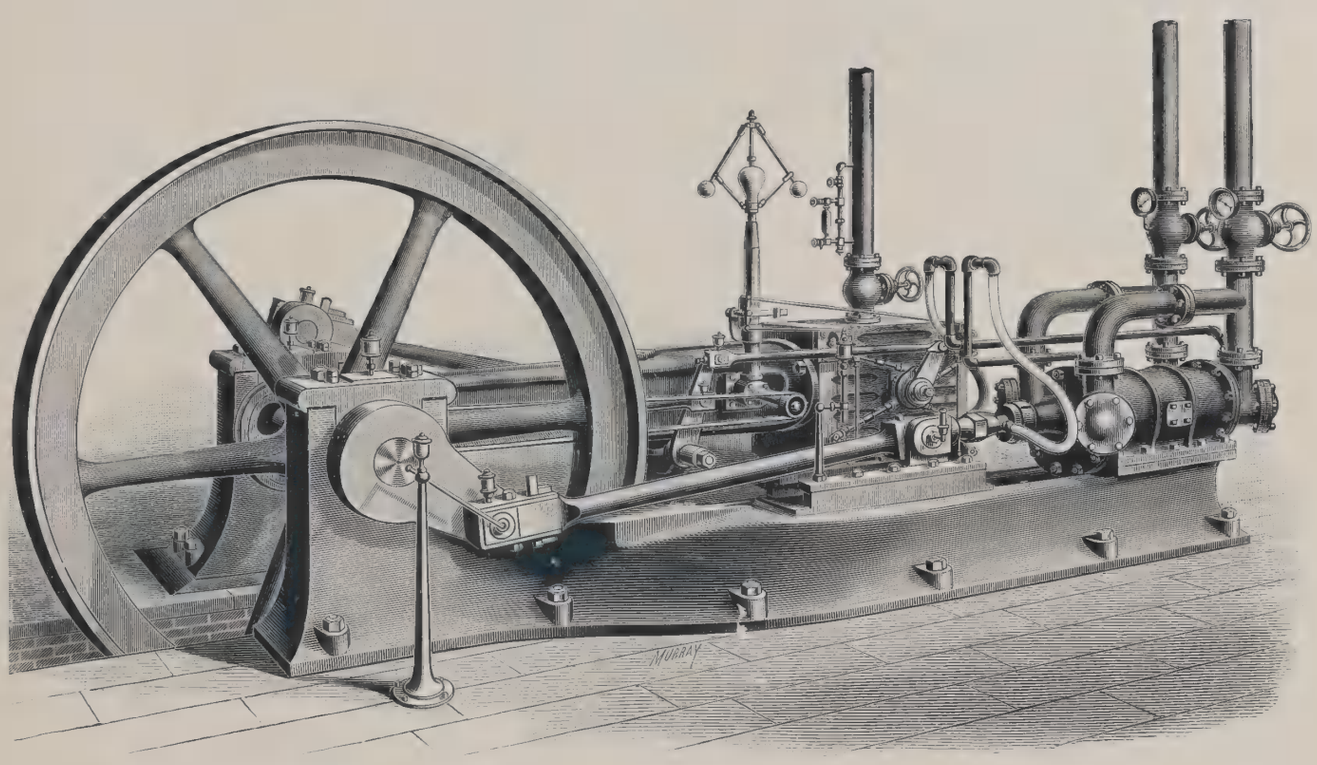
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS,
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

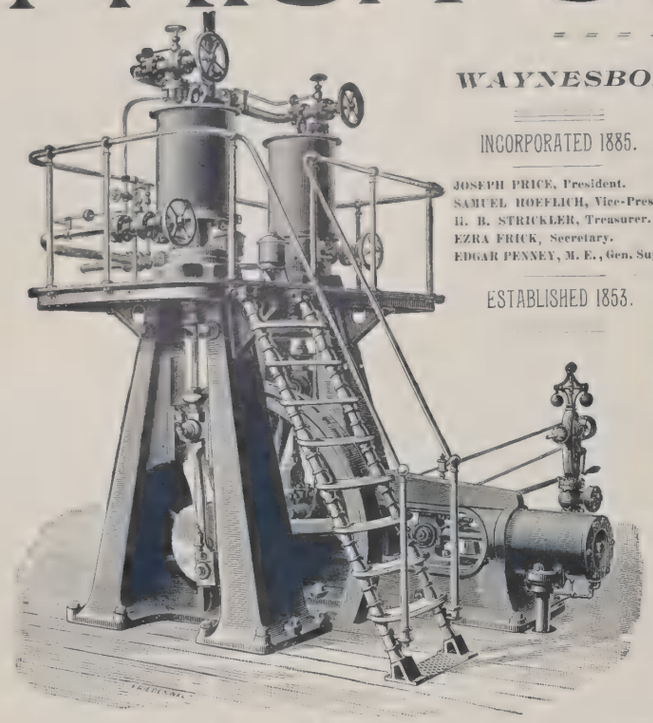
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.

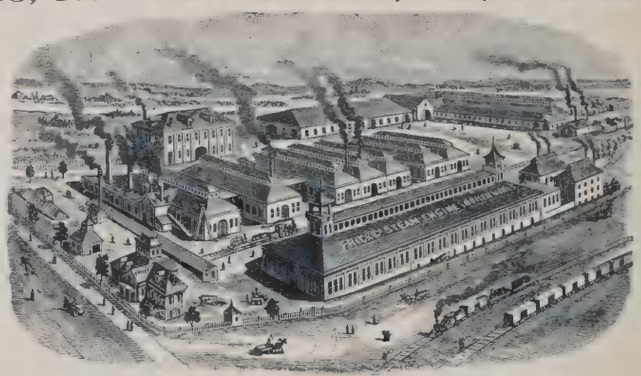


5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

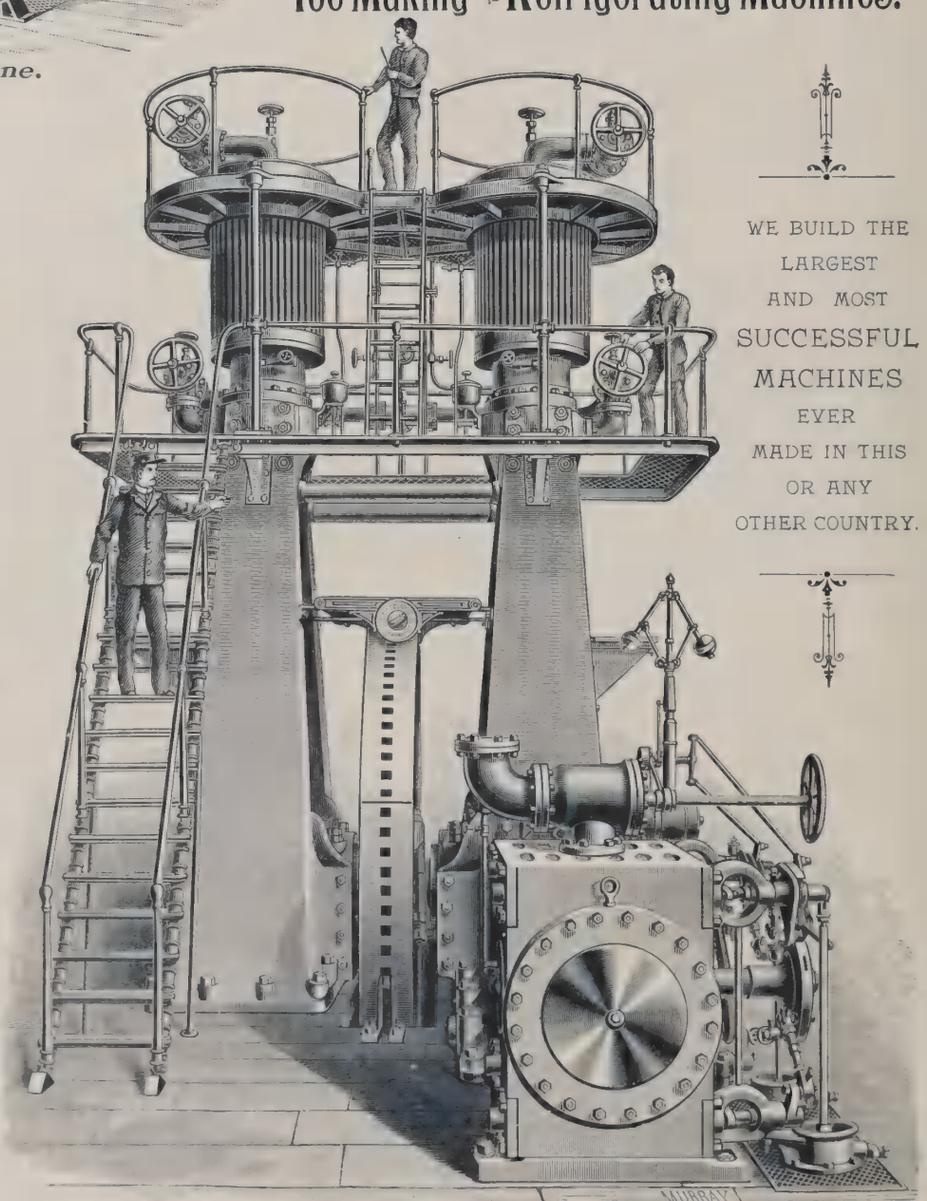
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., Owensboro, Ky	20
W. S. Lurton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa	2
Parkersburg Brg. Co., Parkersburg W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

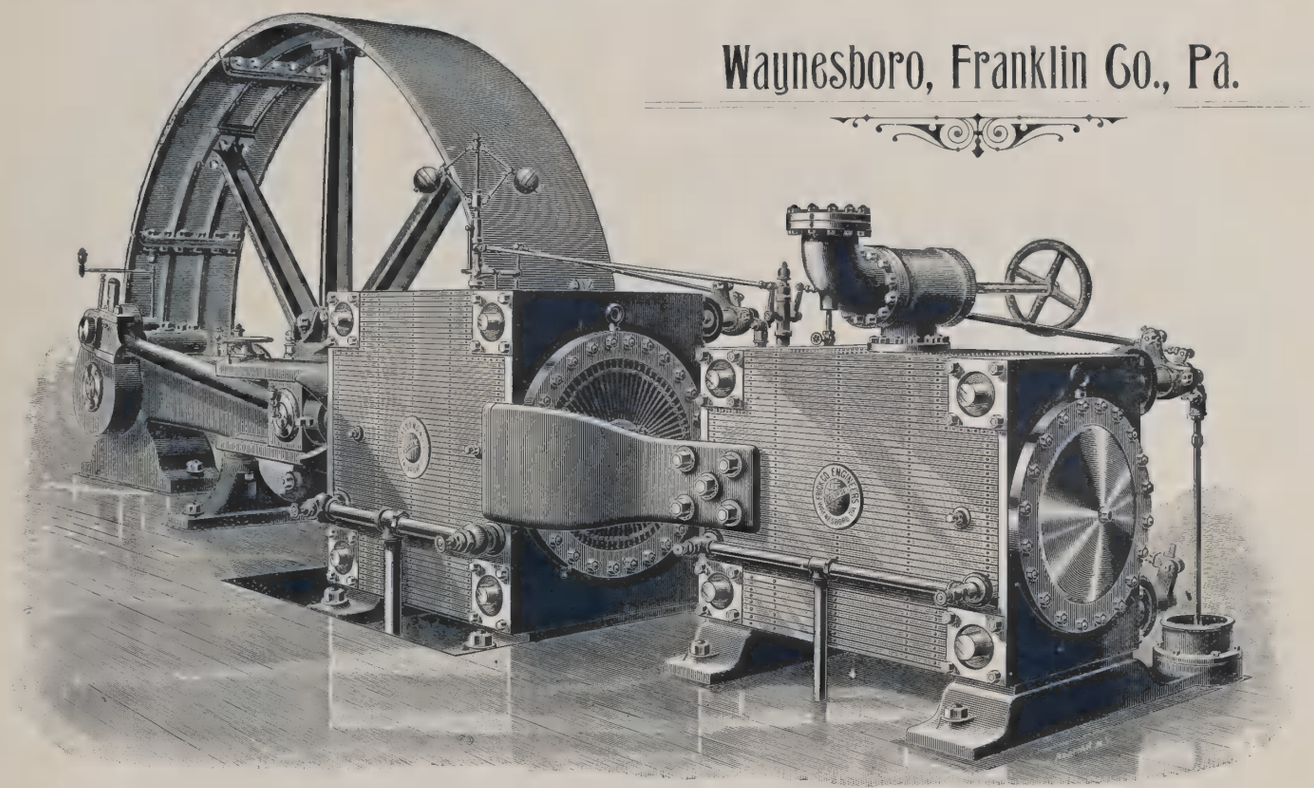


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

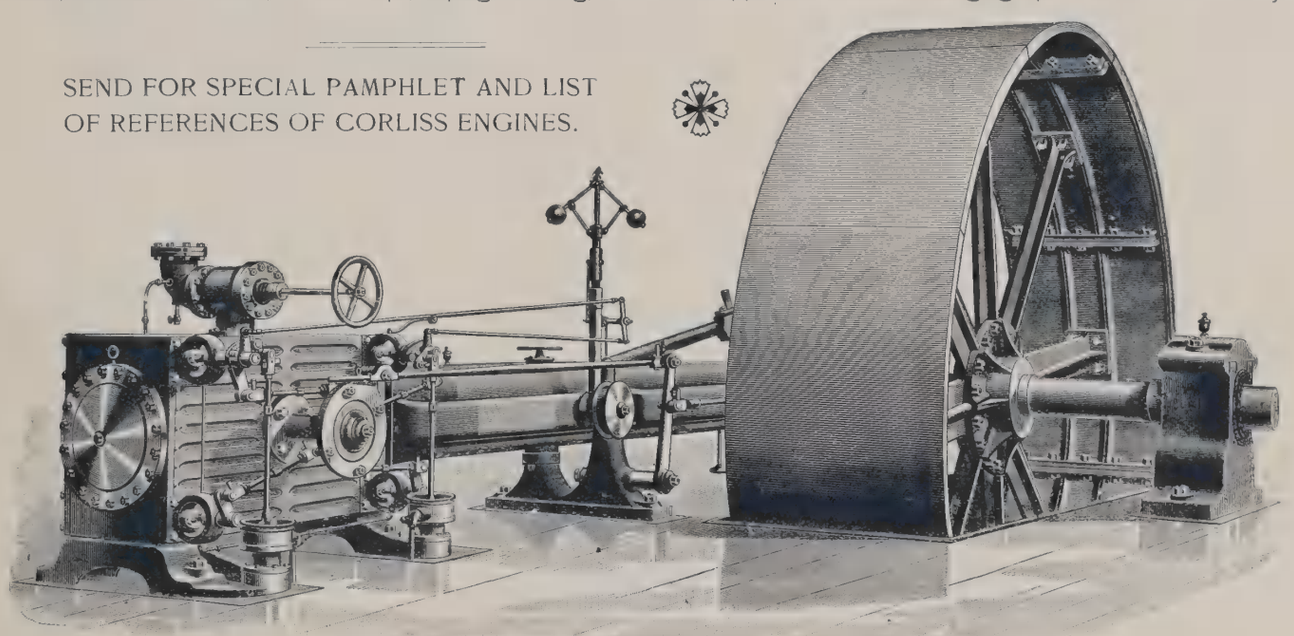
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

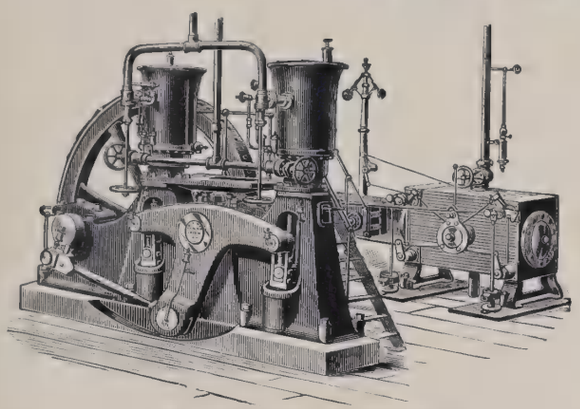
Ammonia Valves, Pipe Coils and Pipe Fittings

. . . . . OF EVERY DESCRIPTION . . . . .

PITTSBURGH, PA.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

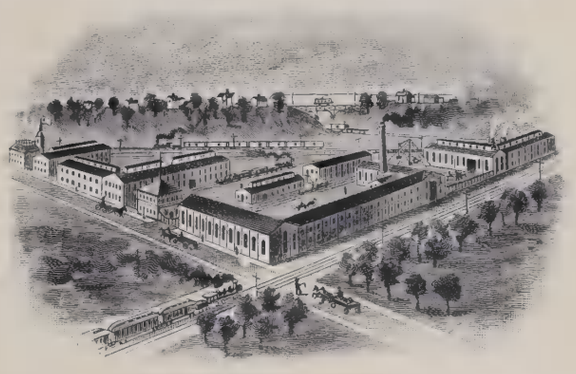
(REFRIGERANT: ANHYDROUS AMMONIA.)



THE HERCULES ICE MACHINE.

The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.



THE HERCULES MODEL ICE PLANT.

LEE WOLF, DEALER IN BEER AND ICE.

MT. VERNON, IND.

September 30, 1891.

DEAR SIRS:

Your favor of the 26th inst. received, and I am pleased to state that having run the seven and one-half ton machine for a period of twelve months (actual running time), I find it has given general satisfaction. It will make more than this amount of ice, but I am using in addition 11,000 feet of cold storage. I gladly add my testimony to the worth of the "Hercules" ice machine.

Yours truly,

LEE WOLF.

FORT WORTH PACKING CO.

FORT WORTH, TEXAS.

November 17, 1891.

GENTLEMEN:

After a thorough examination of the leading machines, we decided upon yours—one 100-tons and one 50-tons. They have accomplished all they were put in for, and we are thoroughly satisfied with them in every respect. We have two large chambers which are refrigerated by the same, and have also shipped thousands of tons of ice from our Packery, and everything has given satisfaction. I have been some eighteen years in the packing business, and have used and tested all the leading machines, but the "Hercules," in my estimation, is far superior to them all. We are well satisfied with our plant.

Respectfully yours, GEO. M. BARNUM,
Gen'l Manager Ft. Worth Packing Co.

THE HERCULES BLUE BOOK No. 1, ON ICE MAKING AND REFRIGERATION, IS JUST ISSUED AND WILL BE SENT FREE TO INTENDING PURCHASERS.

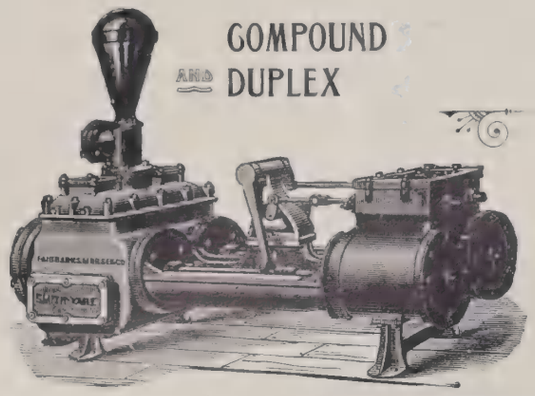
THE HERCULES IRON WORKS,

NEW YORK OFFICE, 150 BROADWAY.

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.

WORKS, AURORA, ILL.

THE SMITH & VAILE CO. DAYTON, OHIO.



COMPOUND AND DUPLEX

STEAM PUMPS

FOR EVERY PURPOSE.

WE MAKE A SPECIALTY OF

BRINE PUMPS,
COLD WATER PUMPS,
BOILER FEED PUMPS.

FOR

Ice and Refrigerating Machines.

Get our Special Prices before buying elsewhere.

NEW YORK HOUSE, 112 LIBERTY ST.

THE GORDON STEAM PUMP CO.

. BUILDERS OF .

Steam Pumping Machinery

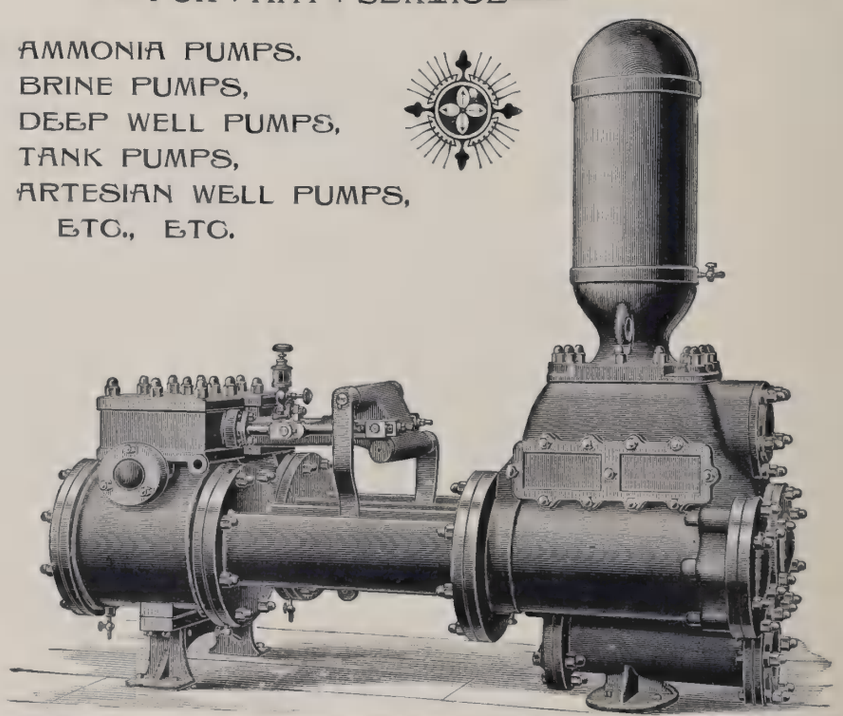
FOR ANY SERVICE

Pumps

ESPECIALLY ADAPTED FOR USE IN CONNECTION WITH

Refrigerating Machinery

AMMONIA PUMPS.
BRINE PUMPS,
DEEP WELL PUMPS,
TANK PUMPS,
ARTESIAN WELL PUMPS,
ETC., ETC.



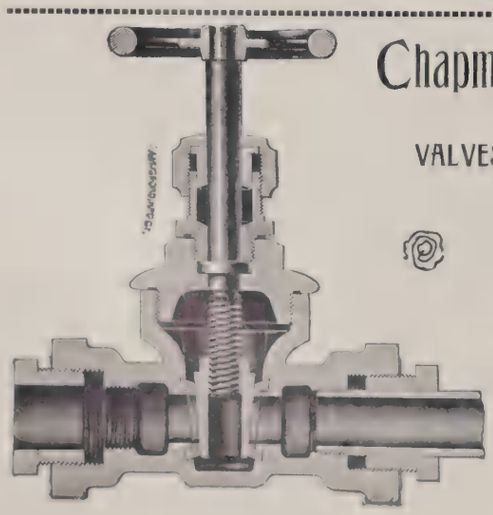
MAIN OFFICE AND WORKS

HAMILTON, OHIO.

BRANCH OFFICES

NEW YORK—136 Liberty St.
PHILADELPHIA—705 Arch St.
PITTSBURGH—410 Lewis Block.
CHICAGO—Phœnix Building.
ST. LOUIS—703 Market St.
CLEVELAND—146 Water St.

Correspondence Solicited.



Chapman Valve Manufacturing Co.

MANUFACTURERS OF

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

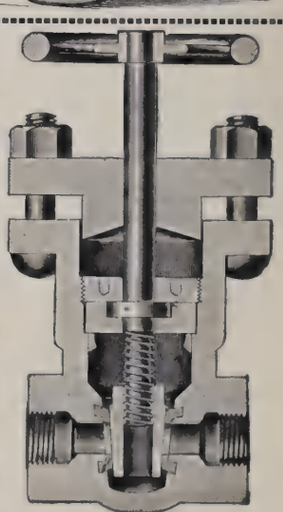
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works, INDIAN ORCHARD, MASS

Treasurer's Office, 72 Kilby and 112 Milk Sts. BOSTON, MASS.



Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

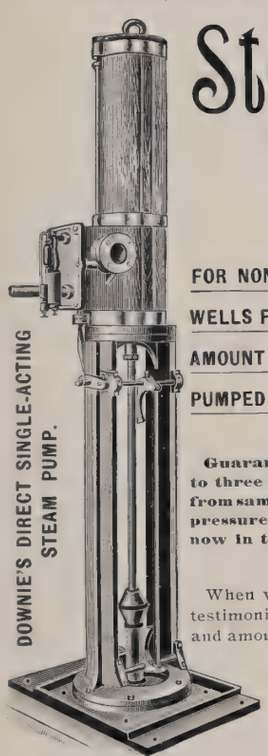
CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.

DOWNIE'S

DIRECT, DOUBLE-ACTING

Steam Pump



FOR NON-FLOWING ARTESIAN WELLS FROM WHICH A LARGE AMOUNT OF WATER IS TO BE PUMPED . . . . . .

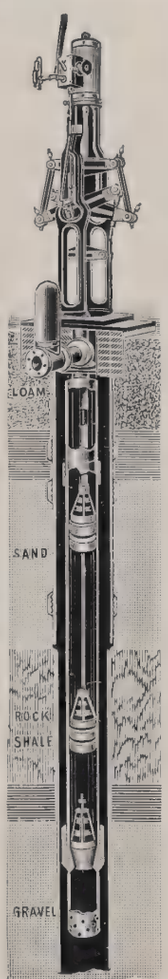
Guaranteed to lift from two to three times as much water from same well and same steam pressure as any other Pump now in the market.

When writing for prices and testimonials, give depth of well and amount of water wanted.

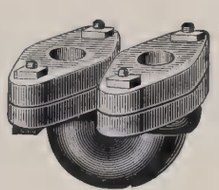
Sole Patentees and Manufacturers,

Downie Bros. & Nevin, Limited

NEW BRIGHTON, PA.



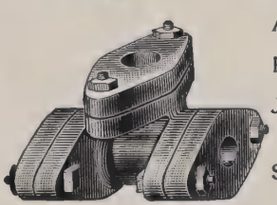
General Ice Factory Supplies



GLAND END AMMONIA FITTINGS AND VALVES,

ASBESTOS PACKED COCKS,

CHAPMAN AMMONIA GATE VALVES,

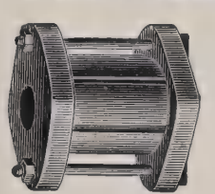


Automatic Ammonia Gauges

Pressure & Vacuum Gauges

Jenkins and Rainbow Sheet Packings,

Selden's Stuffing Box Packing,



Elastic and Sectional Ring Packings,

PURE GUM RINGS—ALL SIZES,

STEAM FITTINGS, TOOLS, Etc.

SEND FOR **416** PAGE ILLUSTRATED CATALOGUE.

RIPLEY & BRONSON,

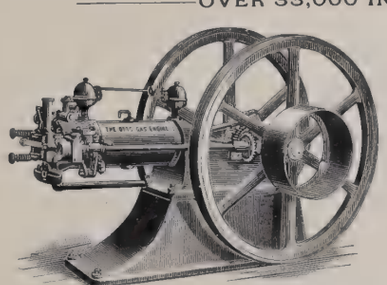
800 North Main St.,

ST. LOUIS, MO.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

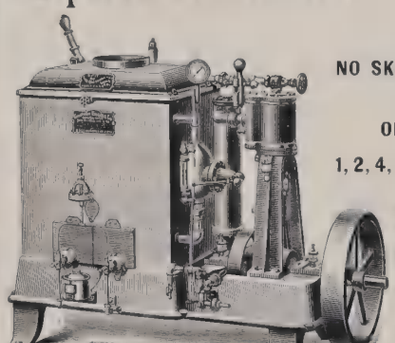
Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

THE

Shipman Automatic Steam Engine



NO SKILLED ENGINEER.

KEROSENE, PETROLEUM OR NATURAL GAS FUEL.

1, 2, 4, 6 and 8 HORSE POWER.

The most reliable, economical and satisfactory power for small

REFRIGERATING MACHINES, CREAMERIES, PACKING HOUSES, BOTTLERS, COLD STORAGE, Etc.

Send for Catalogue. . . . .

SHIPMAN ENGINE CO., 328 Summer Street, Boston, Mass.



THE CHEF.

McGray Refrigerator AND Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS OF ALL KINDS OF

REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,
Loomis Building, Clark and South Water Streets.

THE JACKSON REFRIGERATOR CO.

EXPERTS IN
ICE AND MECHANICAL REFRIGERATION.

Cold Storage Architects

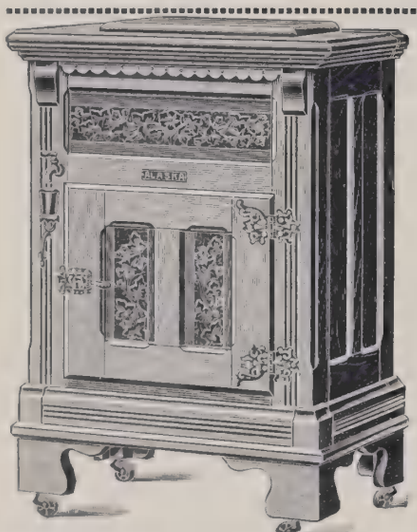
Over 300 Jackson Houses, Cooled by Ice, in Successful Operation.

PLANS AND SPECIFICATIONS FURNISHED FOR BUILDINGS AND MACHINERY.

They never become musty, and carry perishable goods longer and in better condition than any other house.

Send for "Refrigeration," a scientific treatise on Ice Refrigeration, with Circular and Testimonials.

605 RIALTO BUILDING, CHICAGO.



THE ALASKA REFRIGERATOR CO.

MUSKEGON, MCIH.

WRITE FOR CATALOGUE AND PRICE LIST.
SPECIAL REFRIGERATORS MADE TO ORDER.



China Closet, Side Board and Refrigerator.
No. 36¼.

COLD STORAGE FOR FAMILY USE

THE FAMOUS LEONARD CLEANABLE IS THE ONLY PERFECT

Cold Dry Air Refrigerator

THAT HAS PERFECT CIRCULATION. **WON'T SWEAT OR MOLD.** SIX WALLS TO PROTECT THE ICE.

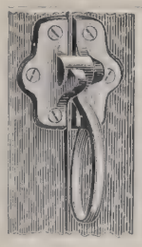
Housekeepers Recognize its Merits

Made in all styles and sizes. Hardwood, Antique or Sixteenth Century Finish, with air tight lock. In buying ask for "LEONARD'S CLEANABLE," and insist on having it. There is no good substitute. Send for illustrated catalogue and price list. New styles for 1892.

GRAND RAPIDS REFRIGERATOR CO.

Sole Manufacturers.

GRAND RAPIDS, MICH.



P. J. CONROY & CO.

75th St. and Island Road,
PHILADELPHIA.

CONROY
MANUFACTURERS OF THE
Refrigerator Door Fasteners
PATENTED DECEMBER 5, 1885.

Which are rapidly supplanting all others. The only fastener that forces the door open as well as shut.

HILPERT & CHANDLER
ENGRAVERS
BY ALL PROCESSES.
REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.
167 DEARBORN ST. CHICAGO.

....THE....
HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

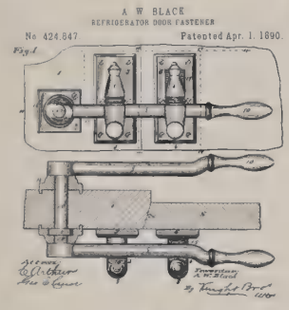
Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,
48 EXCHANGE PLACE, - - - NEW YORK.

BLACK'S — LATEST IMPROVED . . .



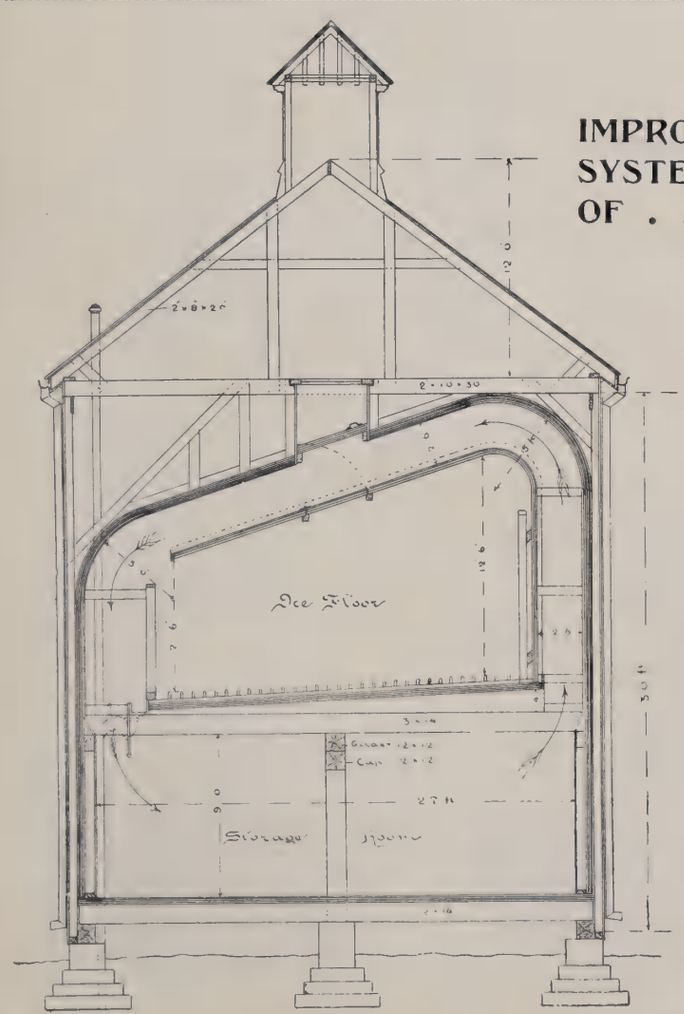
Refrigerator Door Fastener
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
SENT BY EXPRESS ON RECEIPT OF $12.

A. W. BLACK, ST. LOUIS, MO.



BLACK'S
IMPROVED SYSTEM OF . . . . Cold Storage
.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, ST. LOUIS, MO.

THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

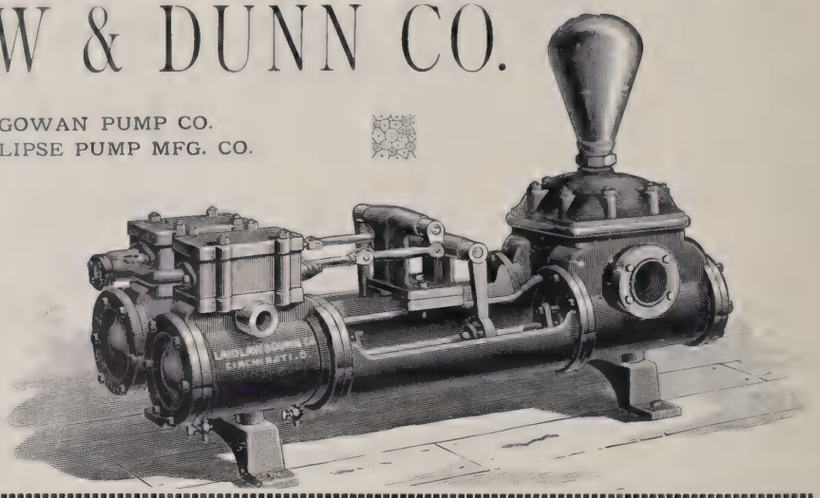
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

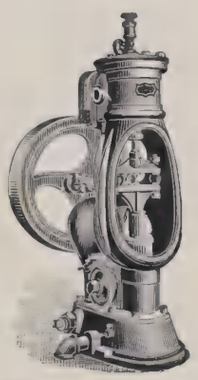
AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . .

PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

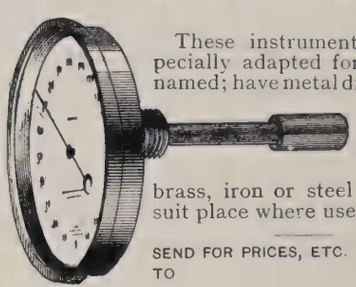
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



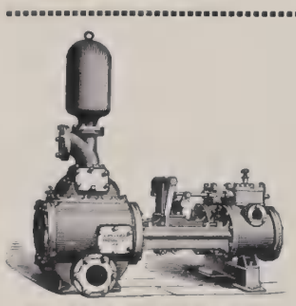
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



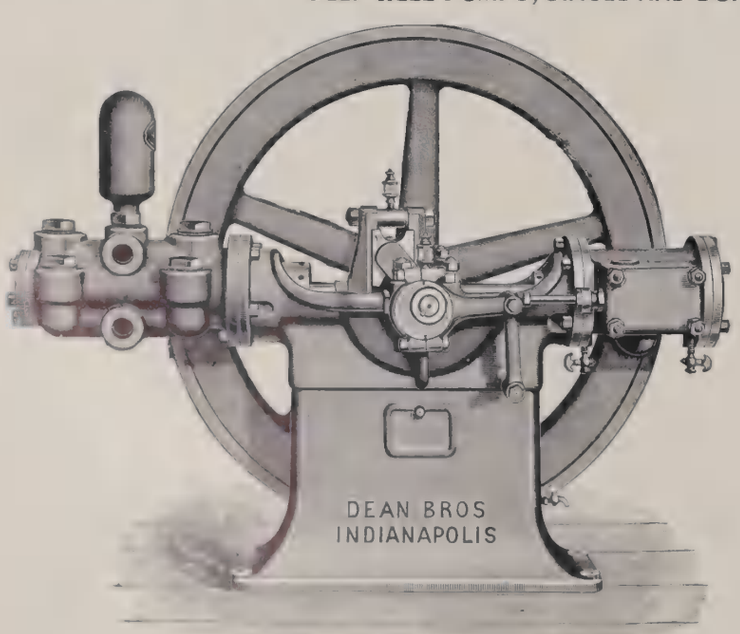
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

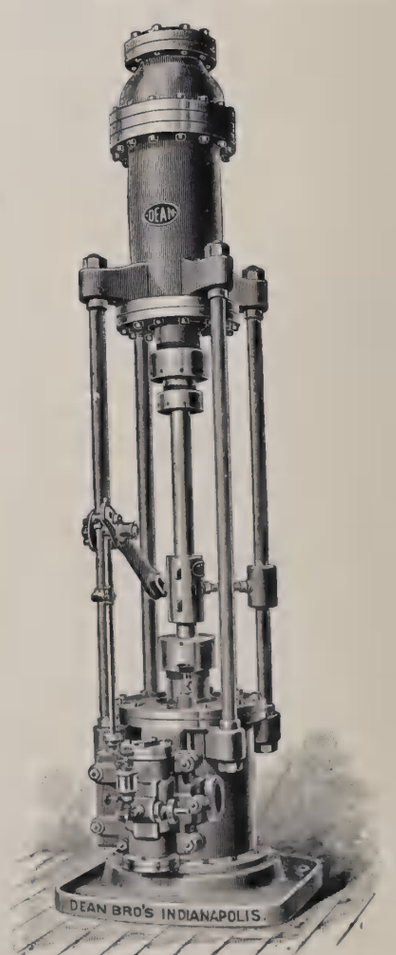
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

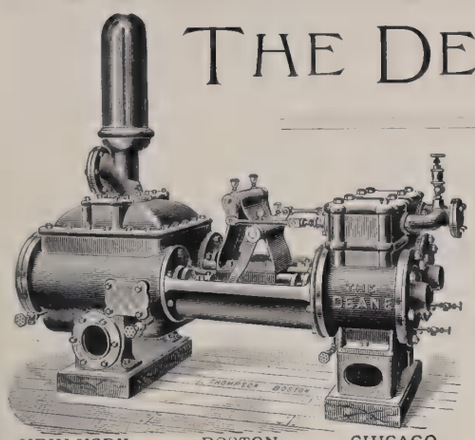
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's Patent Tube Well Strainers

..... AND .....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

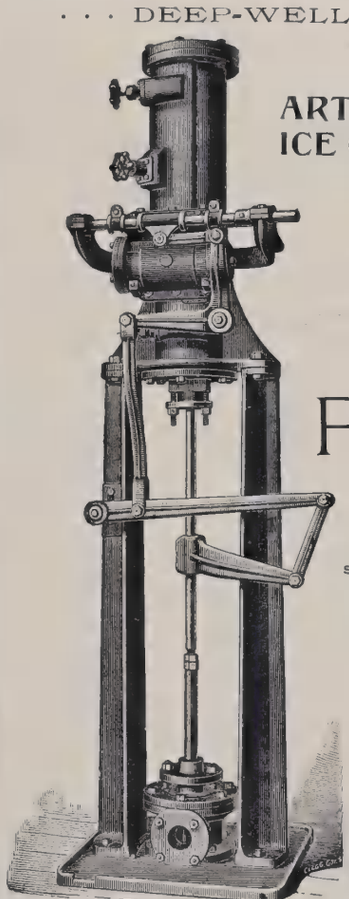
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

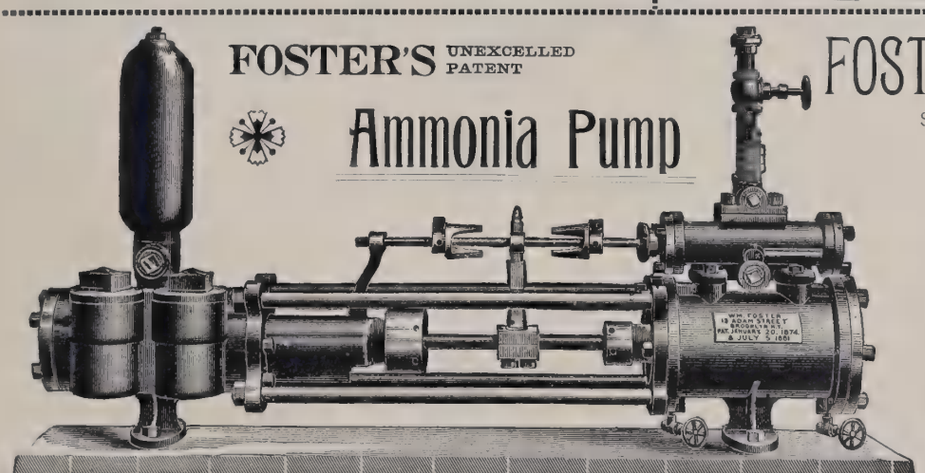
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuff-

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION MACHINES . . . .

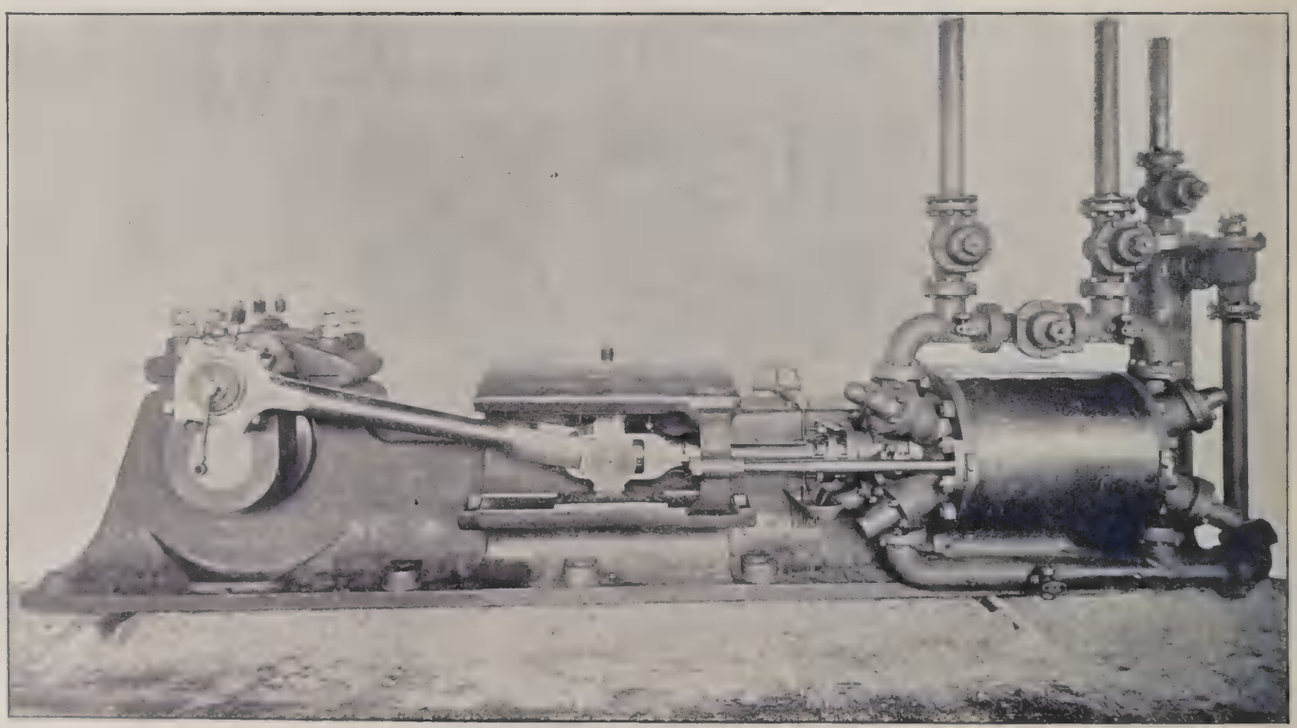
All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.

THE FRED W. WOLF CO.

MANUFACTURERS OF THE

Linde Ice AND Refrigerating Machine

560 North Halsted Street CHICAGO, ILL. U. S. A.



No. 8 Linde Compressor, 100 Tons Capacity.

FOR

Correspondence Solicited . . . .

ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. II. NO. 3. CHICAGO : NEW YORK : MARCH : 1892. $2.00 PER ANNUM.

THE SOUTHERN ICE EXCHANGE.

PROCEEDINGS OF THE THIRD ANNUAL CONVENTION—LIST OF DELEGATES PRESENT—ELECTION OF OFFICERS FOR THE ENSUING YEAR—VOTE OF THANKS TO H. S. RICH & CO., PUBLISHERS OF "ICE AND REFRIGERATION."

Pursuant to call as published in the February issue of ICE AND REFRIGERATION, the members of the Southern Ice Exchange assembled in convention in Odd Fellows Hall, Erswell Building, at Birmingham, Ala., on February 25.

At 10:30 A. M. the meeting was called to order by the president, Mr. W. J. Rushton, who on behalf of the mayor welcomed the delegates to Birmingham.



CHAS. W. BIESE, CHATTANOOGA, TENN., PRESIDENT SOUTHERN ICE EXCHANGE, 1892-93.

LIST OF DELEGATES.

Eight states were represented by delegates. Among those present were the following well known gentlemen:

Mr. Edward E. Eagan, Asheville Ice and Coal Co., Asheville, N. C.

Mr. C. F. Sugg, Huntsville Ice Co., Huntsville, Ala.

Mr. Louis P. Hart, representing Crescent City Ice Co., New Orleans; Central Ice Co., Mobile, Ala.; Gorrie Ice Co., Savannah, Ga.; Charleston Ice Co., Charleston, S. C.; Brunswick Ice Co., Brunswick, Ga.; and Avondale Ice Factory, Avondale, Ala.

Mr. E. B. Palmer, representing Alabama Ice Co., Anniston, Ala., and Troy Ice Co., Troy, Ala.

Mr. W. S. Ware, representing Jacksonville Refrigerator Ice Works, Jacksonville, Fla., and Stratton Ice Works, Pensacola, Fla.

Mr. W. J. Rushton, Birmingham Ice Factory Co., Birmingham, Ala.

Mr. W. J. Hendley, Birmingham Ice Delivery Co., Birmingham, Ala.

Mr. Gooing, Birmingham, Ala.

Mr. W. C. Gray, Americus Ice Co., Americus, Ga.

Mr. Abe Ellis, Columbus, Ga.

Mr. Wm. Hood, People's Ice Co., Powderly, Ala.

Mr. B. J. Dryer, Birmingham, Ala.

Mr. Jack W. Johnson, Birmingham, Ala.

Mr. A. J. Werms, Meridian Ice Co., Meridian, Miss.

Mr. Morris Benjamin, representing Atlanta Ice Factory, Atlanta City Brewing Co. and Standard Ice Co., Atlanta, Ga.

Mr. R. C. Graves and Mr. R. E. Lee, of the Bohlen-Huse Machine and Lake Ice Co., Memphis, Tenn.

Mr. Chas. W. Biese, representing Lookout Ice and Cold Storage Co. and Central Ice Co., Chattanooga, Tenn.

Mr. T. L. McComb, Milledgeville Ice Co., Milledgeville, Ga.

Mr. J. E. McBride, Decatur Ice Co., Decatur, Ala.

Mr. F. E. Brown, Anniston Ice Co., Anniston, Ala.

Mr. R. W. Cole, Birmingham, Ala.

Mr. Paul Waddell, representing I. D. Fletcher, New Orleans, La.

Mr. W. H. Gallenkamp and Mr. H. D. Martin, representing the National Ammonia Co., St. Louis, Mo.

Mr. O. Herf and Mr. W. S. Boyden, representing Herf & Frerichs Chemical Co., St. Louis, Mo.

Mr. J. F. Nickerson, representing ICE AND REFRIGERATION, Chicago and New York.

Many sent word, stating their inability to be present and signifying their willingness to abide by any action taken by the convention.

After the roll call, the minutes of the previous meeting were read and adopted. The report of the treasurer was read by the secretary, and on motion a committee of three was appointed by the chair to examine the same and report to the convention. The president named Mr. Wm. Hood, Birmingham, Mr. F. C. Browne, Anniston, and Mr. M. Benjamin, Atlanta, as such committee.

The regular order of business was then dispensed with, and by request Mr. Rushton explained briefly the objects of the association. This provoked a general discussion, participated in by Messrs. Graves, Memphis; Benjamin, Atlanta; Biese, Chattanooga; Palmer, Anniston; Ware, Jacksonville; Gray, Americus; Hart, New Orleans; and Hood and Rushton, Birmingham, as to the best methods to adopt for the purpose of strengthening the association and broadening the scope of its action. Especial stress was laid on the necessity of inducing the outside factories to join the association. Finally, on motion of Mr. Benjamin, a committee of five was appointed by the chair to "devise ways and means to strengthen the association, to induce new members to join, and to formulate some plan by which the business could be conducted so as to prevent ruinous competition between members of the Exchange."

The president appointed Messrs. Benjamin, Graves, Ware, Sugg and Gray as the committee, with instructions to report at the evening session.

An adjournment was then taken to 2.30 P. M.

AFTERNOON SESSION.

On re-assembling at the hall, President Rushton announced that, with the approval of the members, the afternoon session would be devoted to an informal and friendly interchange of ideas and discussion of subjects of interest to the trade. The members talked very freely about their several ways of conducting business, methods employed and the results obtained. Many an amusing incident was related of the experiences of the "ice man" in his retail business.

A good story, and one vouched for by Mr. Louis P. Hart as having actually occurred only recently at Savannah, Ga., was as follows: The lady of the house hailed the ice wagon as it was passing by, and asked for "five cents' worth of ice, as her baby was sick." The driver stopped, and not having so small a piece as five pounds, cut up a full block to get a piece of that weight, consuming valuable time in so doing, which entailed a loss in shrinkage on his load of ice of several pounds. He sent the five pounds into the house by his helper, which was, however, sent back with the word that "as the baby was better she would not take the ice until the next day." Mr. Hart failed to chronicle the remarks of the driver.

This was nearly equaled by the story of the frugal housewife who, on paying the driver of the ice wagon for five pounds of ice, said she "would take two and a half pounds of ice to-day and some other time would take the other two and a half pounds."

EVENING SESSION.

At half past eight o'clock President Rushton called the meeting to order and the following paper on "Distillation and Filtration of Water for the Manufacture of Ice" was read by Mr. Chas. W. Biese, of Chattanooga, Tenn.

Mr. President and Gentlemen: I have been requested by this body to write an article on "Distillation and Filtration of Water for the Manufacture of Ice."

I have not been able to give this important subject the attention it required; and not being a scientific man, I can give no details based upon scientific experiments, but must confine myself to a plain story of what my experience has taught me during the years that I have been engaged in the manufacture of ice.

DISTILLED WATER.

Among the different waters with which we are familiar, distilled water is the nearest approach to absolute purity, though even this contains one-eighth of a grain of solid matter (chiefly the chlorides) in every gallon. Rain water as it comes from the heavens ranks next, but it averages a grain of solid matter to the gallon under the most favorable circumstances.

As distillation is a generic term for a class of chemical operations in which all agree that the substance operated upon is heated in a close vessel, and thereby wholly or partially converted into vapor, which is then condensed by the application of cold in another apparatus, and in a third portion of the apparatus allowed to collect in its liquid form ready for use, allow me to call your attention to the distilling apparatus now used in our ice factories. Should I endeavor to explain the good and bad parts of each one that has come under my observation, I should consume too much of your time, and yet perhaps fail to make it clear; and for these reasons I shall not attempt to dwell upon them in detail, but simply refer to them in a general way.

In each of the two principal classes of ice machines, we find a marked difference in the *modus operandi* in the distillation of water. The compression ice machines generally use as the vaporous substance to be distilled the exhaust steam of their large compression engines. In only a few instances that have come to my knowledge has direct steam been used. For this reason this class of machines has to use a special apparatus to take out all impurities with which the exhaust steam may be impregnated, such as lubricants, etc. On the other hand, the absorption machines use the steam which has heated the retort, assisted by direct steam from the boiler. This gives water free of such contamination. The closest attention of the operator of either class of ice machines is called to the following: To obtain water free from taste, smell, color or air has been the constant effort of all good ice makers, and the failure to accomplish this end has been the ruin of many otherwise successful ice manufacturers. At one point the manufacturers of all ice machines agree, and that is, that the distilled water, whether we use direct or exhaust steam, must come primarily from our boilers. This being true, the first care should be to see that the water entering into our boilers is of the right kind and manipulated in the proper manner. My experience has taught me to doubt the truth of the statement, so often made, to the effect that all water, no matter how impure, will part with such impurities when frozen or evaporated. Indeed, I almost feel free to say that I know the reverse to be true. I have several times known of water being so impregnated with gaseous impurities that when it was evaporated and again condensed it still retained its bad taste, disagreeable smell or undesirable color. Freezing it did not change its condition.

Please give the clipping I will now read your attention for a moment. It does not directly concern the question of the distillation of water, but, as it refers to

the gases with which water is frequently impregnated, it has an indirect bearing on this subject, of some considerable importance:

A NEW PRINCIPLE OF STEAM BOILERS.

An address was delivered before a society of engineers at Bridgeport, Conn., the other evening by F. G. Fowler, concerning his discovery of a property of steam which under some circumstances will cause an instantaneous doubling of boiler pressure without the application of more heat. His claims were demonstrated by a small boiler in which the pressure was raised to forty pounds and after being removed from the fire suddenly thrown to eighty pounds. In another experiment the pressure was raised in an instant from eighty pounds to 160. The claim is made that this peculiar property of steam is the cause for many explosions in boilers which have endured the inspector's test and have exploded at other times, when the pressure was apparently lower.

The speaker illustrated his principle as follows: Suppose a boiler in one of our factories had been tested to 120 pounds by the inspector, and that it was capable of withstanding 150 pounds pressure without exploding, and that it was carrying eighty pounds of steam. Now if by chance the same combination of conditions should be produced as I have produced in experiment, so that the pressure was instantly raised from eighty to 160, an explosion would have been inevitable, and one would then have a boiler which was tested to 120 pounds and capable of standing 150 that exploded when the gauge was indicating eighty. This is as mysterious an explosion as any that comes to our knowledge, and we have in the experiment a rational explanation of what has heretofore been a mystery, one based on natural laws that can be demonstrated to exist. It was then shown that the cause of this sudden rise of pressure was due to a certain combination that existed in the boiler, and that one of the essential elements of that combination was the impregnation of the water with gases—which were of no earthly benefit, but on the contrary a detriment—and that by the removal of those the danger is obviated. This claim was demonstrated by expelling a portion of the gases from one of the boilers, and then repeating the experiment when the rise was only between one and two pounds.

What is the remedy for this disease? Is there no balm in Gilead? It is held by many, and with a great deal of reason, that water purifiers should be used for cleansing the water before it goes into the boilers. Others contend that the water from the boilers may be kept clean and pure by frequent blowings off and by the use of boiler cleaners or machines for taking the scum from the top of the water in the boilers. Many manufacturers are so situated that they cannot attach costly purifiers, so that they must remedy the evil by the means which are at their command. I have known such an instance as this to occur: One manufacturer had clear-looking spring water from which to feed his boilers and get his distilled water. A competitor had dirty-looking river water. The former made poor ice. The latter as pretty ice as ever was seen. The difference was in the manipulation more than in the water.

My own experience has been that we can obtain pure and good water by having our engineers and stokers pay close attention to the management of our boilers, *i. e.*, to have the boilers frequently cleaned by blowing out, etc. To do this I would recommend to all the placing of an extra boiler in your battery so that every three or four days one boiler may be cooled and thoroughly renovated. I would also recommend that boilers be blown off every four hours. This to me is an essential point. One of the things I seek to impress upon our engineers is the importance of keeping the water line at a regular point—never allowing too high a gauge of water. The least neglect in this will give trouble. I know of an instance in which a large amount of mud and foul matter was carried over through the steam pipes, through the distilling apparatus, through the filters and into the freezing cans by the neglect of a stoker in carrying too high a water line, and this in face of the fact that the distilling and filtering apparatuses were situated twenty feet higher than the boilers. It took over a week to recover from the effect of this piece of neglect.

I would prefer to have water purifiers attached to the boilers, if such can be done without too great an extra expense; and if I were to purchase a new plant I would certainly see that water purifiers were included in the contract.

The distillation of pure, odorless and tasteless water presents difficulties also worth consideration. Water merely evaporated and recondensed has a very disagreeable, empyreumatic odor and a most repulsive flat taste, and it is generally thought that it is only after repeated pourings from one vessel to another, or continued agitation of some other kind and long exposure to pure air, that it becomes sufficiently aerated to lose its unpleasant taste and smell. This plan of aerating the water before freezing we could not adopt without in some way agitating the water in the cans while freezing, which you can see for many reasons would not be practicable.

In most, if not all, ice machines there is a reboiling apparatus differing with different factories and inventors. When this apparatus is in operation, care should be given to see that it is kept full enough of reboiled water to allow a free overflow and give all impurities a chance to escape, leaving the pure distilled water to run through the filters and into the freezing tank. If the tank man is careless and fills his cans irregularly, drawing at times too much water from the reservoir and thus emptying the reboiling apparatus and causing the recondensed water to run through the filter without first having been freed by the overflow from all impurities, it will be an impossibility to make pure ice, no matter how excellent your system of filtration may be.

FILTERS.

The filters most used in our ice machines, as far as my observations extend, are the charcoal filters. However, some of our successful operators have used a small amount of coke with satisfaction. Some have used layers of white sand and gravel, separated by small screens. Some have agitated the question of using the Pasteur filter, but if it has resulted in anything more than agitation I know nothing of it.

Allow me to say, in closing, that an ice manufacturer, to be successful in the manufacture of pure ice, must give special attention to his filters. Pure ice is the reward of scrupulous cleanliness in all departments, and in none is this more true than that art relating to the filtering. A foul filter is a ruin to an ice machine. Filters should be so constructed that they can be washed out and cleaned although the machines are kept running. Filtering through sponge boxes after the water leaves the charcoal filter has been found a good thing in our factory, and I would recommend them. Open sponges should be used, and they washed out every six hours.

Gentlemen, these are my ideas on the subject of "Distillation and Filtration of Water for the Manufacture of Ice," based upon an experience gained while using the water of the turbid Tennessee, and they are yours for what they are worth.

Mr. Biese was highly complimented by the members for the excellence of his paper, and the subject was further discussed by Messrs. Eagan, Graves, Palmer, Benjamin and others.

Mr. Benjamin, of the ways and means committee, reported that it was the sense of his committee that before trying to adjust prices or adopt rules to regulate trade, a more determined effort be made to increase the membership of the Exchange, and recommended that a competent man be employed to visit all outside factories and endeavor to induce them to join.

It was moved to receive the report, and the committee was discharged. After some little discussion, a motion was adopted that "the incoming officers be instructed to ascertain the cost, and correspond with all the members of the Exchange as to their willingness to contribute toward the expenses of carrying out the recommendations of the committee."

Mr. Hart moved that Article 1 of the By-Laws be changed so as to merge the offices of secretary and treasurer into one. Adopted.

It was suggested by Mr. Hart that the time for holding the annual meeting be changed to some time in November, at the close of the season, when members could more readily get away from their business, it being likely to result in a larger attendance. Mr. Rushton also favored this change, as at that time all the circumstances attending the season's business would be fresh in the minds of all, and the differences between any of the members and arrangements for the next season could be more easily and satisfactorily adjusted. This change was, however, opposed by some delegates, and after thoroughly canvassing the matter it was finally decided to fix the time of meeting on the second Tuesday in February, each year, as provided by the By-Laws.

Mr. Hood, of the committee appointed to examine the treasurer's statement, reported that they found the account to be correct, and on motion the report was adopted.

The election of officers for the ensuing year was then taken up. Mr. C. W. Biese, of Chattanooga, Tenn., and Mr. W. J. Rushton, of Birmingham, were placed in nomination. Mr. Rushton declined to run for another term; and against Mr. Biese's protest, asking to be relieved, it was moved and carried that the secretary cast one ballot for Mr. Biese as president, and he was declared duly elected.

Mr. Rushton, Mr. Hart and Mr. Benjamin were placed in nomination for vice-president. At their request the names of Messrs. Hart and Rushton were withdrawn, and on motion the secretary was instructed to cast one ballot for Mr. Morris Benjamin as vice-president.

Mr. Abe Ellis and Mr. C. F. Sugg, of Huntsville, Ala., were nominated for secretary and treasurer. Mr. Ellis declined to serve again, and on motion the secretary was ordered to cast one ballot for Mr. Sugg.

The convention then proceeded to the election of an executive committee. The following-named gentlemen were placed in nomination and elected by acclamation: Mr. A. J. Werms, Meridian, Miss.; Mr. Abe Ellis, Columbus, Ga.; Mr. Edward E. Eagan, Asheville, N. C.; Mr. Louis P. Hart, New Orleans, and Mr. W. J. Rushton, Birmingham.

Mr. Rushton, on calling Mr. Biese, the newly elected president, to the chair, took occasion to thank the members of the Exchange for their uniform kindness and the many courtesies extended to him while their president.

Mr. Rushton presented the new president as a gentleman of high character and ability, and, as founder of the Exchange, justly entitled to be its president.

Mr. Benjamin moved a vote of thanks to the retiring president. Carried by acclamation.

Mr. Sugg moved a vote of thanks to the retiring secretary. Carried by acclamation.

Mr. Abe Ellis moved a vote of thanks to Mr. Erswell for use of hall. Carried.

The selection of the next place of meeting was then declared in order.

Mr. Werms offered Meridian, Miss.; Mr. Benjamin moved that Atlanta, Ga., be selected; Mr. Sugg suggested New Orleans. A vote being taken, it resulted in the selection of Atlanta, Ga.

At this point President Biese, being obliged to leave the meeting in order to take a train for home, called Vice-President Benjamin to the chair.

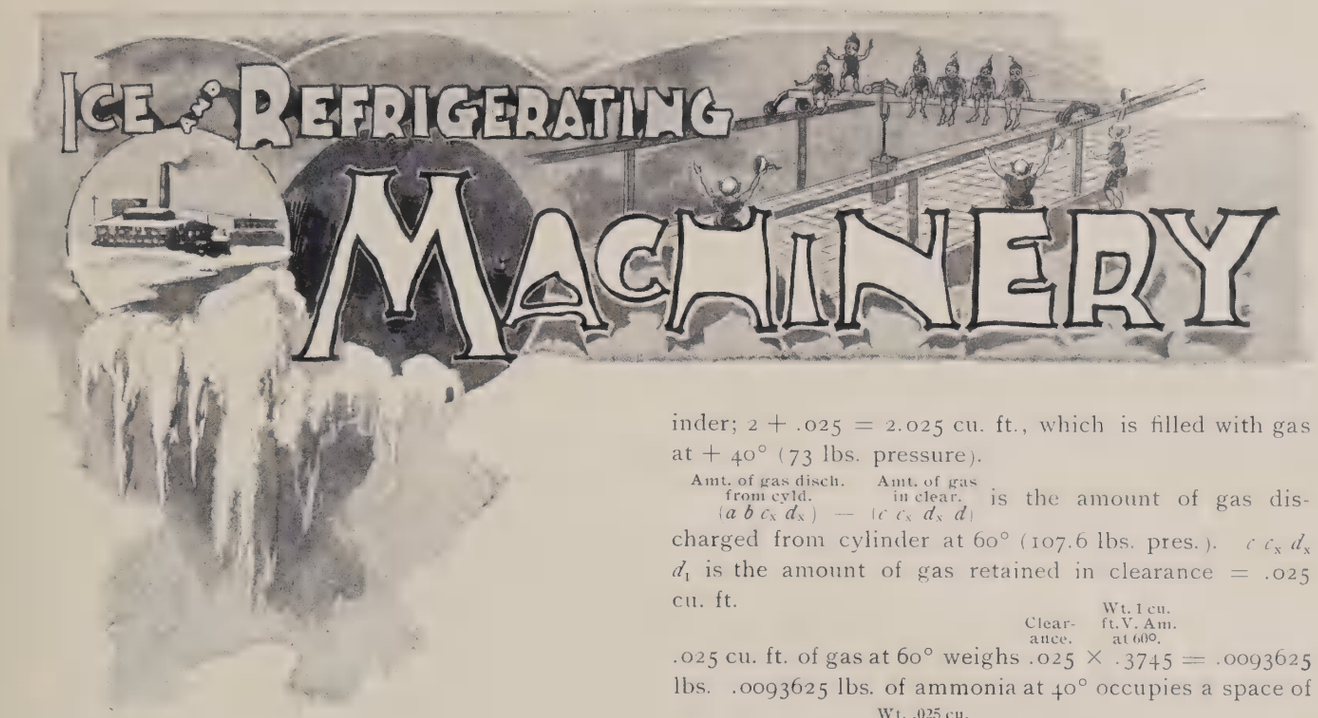
It was then moved and carried that should the Exchange employ a man to visit the different ice companies he also be authorized to collect back dues from delinquent members, and upon his report of failure to collect that such names be stricken from the rolls.

Mr. Rushton moved a vote of thanks be extended to Messrs. H. S. Rich & Co., publishers of ICE AND REFRIGERATION, expressing the appreciation of the Southern Ice Exchange of this very elegant and able publication, which was a credit to the trade and deserving of the highest commendation; and instructing the secretary to officially notify the publishers of this resolution. The motion was seconded by several delegates and passed by acclamation.

The convention then adjourned *sine die*.

A NEW YORK apple grower, summing up his experience, says that if fruit is accidentally frozen it may be preserved from rotting or injury to its appearance by leaving it undisturbed until it has thawed out by the natural change of temperature, covering it with straw or hay to delay the thawing and make it as gradual as possible. As to the question whether the freezing and thawing will injure their keeping qualities, he says: "I maintain that it does, and they will rot sooner than would the same quantity of the same kind of apples or pears that have remained sound and unfrozen up to the same time. The best keeping conditions are to be found where the fruit is not only kept from becoming frozen, but in a uniformly cold temperature with but slight variations toward either extreme."

A KANSAS paper says that several car loads of assorted apples from the famous Wellhouse orchard in that state have gone into cold storage, enabling the owners to obtain a higher price and a surer market. On their arrival in Philadelphia or Baltimore they go immediately into the refrigerating rooms, where it has been found that fruit will keep almost indefinitely if the temperature is not allowed to vary. Apples put into these rooms do not need sorting or inspection until the time comes for them to go on the retail market. Then next May or June the fruit will be taken out just as fresh as they were packed, and bring, it is said, at times as much as 10 cents apiece. Cold storage is one of the horticulturist's greatest allies.



[*Written for* ICE AND REFRIGERATION.]

TO CALCULATE CAPACITY.—II.

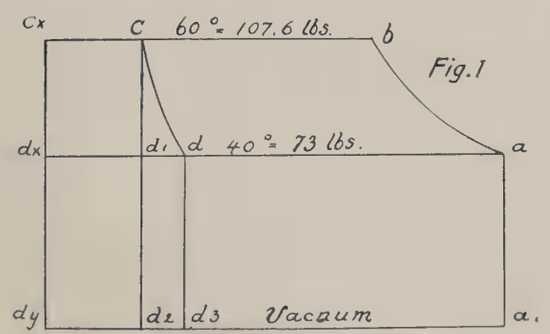
LOSSES DUE TO CLEARANCE IN CYLINDER OF AN AMMONIA COMPRESSION REFRIGERATING MACHINE UNDER VARYING REQUIREMENTS AND CONDENSING TEMPERATURES.

BY EDWARD C. POST, M. E.

We have previously determined what the theoretic ice melting capacity of a *perfect* double-acting ammonia compressor, under varying requirements, is. Now, we will investigate the amount of loss occasioned by clearance in cylinder (waste space at end of stroke + valve chambers + counterbore + etc.) and determine its effective capacity.

The temperatures and cubic contents of cylinder (2 ft. × 2 ft. × 50 Rev. D. A.) will be the same as in our former calculation, while the amount of clearance will be taken at $\frac{1}{80}$ (= 1¼ per cent = .025 cu. ft.) of the cubic contents of the cylinder.*

Fig. 1 is a diagram representing the gas entering the cylinder at a temperature of + 40° F. = 73 lbs. (back)



pressure (absolute), and leaving it at a temperature of 60° F. = 107.6 lbs. pressure (absolute):

$(a\ d_1\ d_2\ a_1) + (d_1\ d_x\ d_y\ d_2)$ (Cylinder. Clearance.) is the cubic contents of cylinder; 2 + .025 = 2.025 cu. ft., which is filled with gas at + 40° (73 lbs. pressure).

$(a\ b\ c_x\ d_x) - (c\ c_x\ d_x\ d)$ (Amt. of gas disch. from cyld. Amt. of gas in clear.) is the amount of gas discharged from cylinder at 60° (107.6 lbs. pres.). $c\ c_x\ d_x\ d_1$ is the amount of gas retained in clearance = .025 cu. ft.

.025 cu. ft. of gas at 60° (Clearance. Wt. 1 cu. ft. V. Am. at 60°.) weighs .025 × .3745 = .0093625 lbs. .0093625 lbs. of ammonia at 40° occupies a space of

$$\frac{\text{Wt. .025 cu. ft. V.Am. at 60°.}}{\text{Wt. 1 cu. ft. of V. Am. at 40°.}} = \frac{.0093625}{.2577} = .0363 \text{ cu. ft.}$$

The .0093625 lbs. which occupied a space of .025 cu. ft. at 60° now occupies a space of .0363 cu. ft. The useful part of the compressor, therefore, is:

$$(a\ d_x\ d_y\ a_1) - (d\ d_x\ d_y\ d_z - d_1\ d_x\ d_y\ d_2) \text{ or}$$
$$2.0 - (.0363 - .025) = 1.9887 \text{ cu. ft.}$$

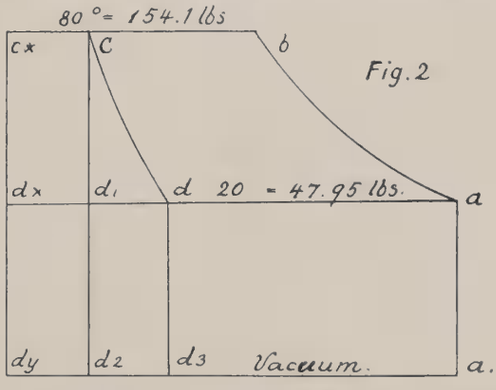
which is the effective displacement of the cylinder.

The effective capacity of the cylinder is represented by the equation:

$$2 : 145.1 = 1.9887 : x$$
$$x = 144.23 \text{ tons of melting ice.}$$

The loss due to clearance is: .87 tons = .6 per cent.

Fig. 2 represents the gas entering the cylinder at + 20° = 47.95 lbs. (back) pressure and leaving it at



80° = 154.1 lbs. pressure $(a\ d_1\ d_2\ a_1) + (d_1\ d_x\ d_y\ d_2)$ = 2 + .025 = 2.025 cu. ft., representing the amount of gas which fills the cylinder at 20° (= 47.95 lbs. pressure). $(a\ b\ c_x\ d_x) - (c\ c_x\ d_x\ d_1)$ is the amount of gas discharged from cylinder at 80° (= 154.1 lbs. pressure). $(c\ c_x\ d_x\ d_1)$ is the amount of gas retained in cylinder = .025 cu. ft. at 80° (154.1 lbs. pressure), which is:

$$\frac{.025 \times .5291}{.1721} = .0768 \text{ cu. ft. at } 20°.$$

This leaves the useful portion of the compressor $(a\ d_x\ d_y\ a_1) - (d\ d_x\ d_y\ d_z - d_1\ d_x\ d_y\ d_2)$ or 2.0 — (.0768 —

* NOTE.—One-eightieth clearance is much in excess of what ought to exist in a well constructed compressor, of the dimensions given, but is taken in order to more prominently point out the difference, under the three requirements assumed.

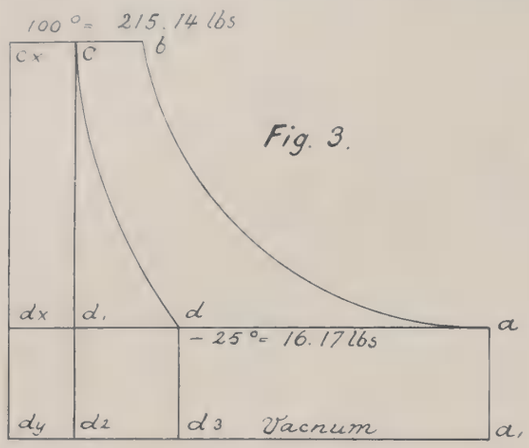
.025 = 1.9482 cu. ft., the effective displacement of the cylinder.

The effective capacity of the cylinder is represented by the equation:

$$2 : 77.47 = 1.9482 : x$$
$$x = 75.45 \text{ tons of melting ice.}$$

The loss due to clearance is: 2.02 tons = 2.67 per cent.

Fig. 3 represents the gas entering the cylinder at − 25° = 16.17 lbs. (back) pressure and leaving it at



100° = 215.14 lbs. pressure. $(a\ d_1\ d_2\ a_1) + (d_1\ d_x\ d_y\ d_2) = 2 + .025 = 2.025$ cu. ft., represents the amount of gas entering the cylinder at — 25° (= 16.17 lbs. pressure). $(a\ b\ c_x\ d_x) - (c\ c_x\ d_x\ d_1)$ is the amount of gas discharged from the cylinder at a temperature of 100° (= 215.14 lbs. pressure); $(c\ c_x\ d_x\ d_1)$ is the amount of gas retained in the cylinder = .025 cu. ft. at 100° (215.14 lbs. pressure), which is:

$$\frac{.025 \times .7353}{.0609} = .303 \text{ cu. ft. at } -25°.$$

The useful portion of the compressor then is: $(a\ d_x\ d_y\ a_1) - (d\ d_x\ d_y\ d_2 - d_1\ d_x\ d_y\ d_2)$ or $2 - (.303 - .025) = 1.722$ cu. ft., the effective displacement of the cylinder. The effective capacity is represented by the equation:

$$2 : 22.6 = 1.722 : x$$
$$x = 19.45 \text{ tons of melting ice.}$$

The loss due to clearance is: 3.15 tons = 13.9 per cent.

Expansion Temperature Returning Gas.	Condensing Temperature Discharged Gas.	Theoretic Capacity.	Effective Capacity.
40	60	100	99.38
20	80	53.39	51.96
−25	100	15.57	13.40

If we call the first example, with temperatures ranging from + 40° to + 60°, the most advantageous condition for a refrigerating machine, and place its theoretic value at 100, we will find in the annexed table the corresponding values for the other requirements.

To the Editor: You will please insert a correction of two mistakes in calculation, which appeared in my article, "To Calculate Capacity," in the February number of ICE AND REFRIGERATION, namely: Page 109, line 2, should read:

$$(34.36 \times 504.66) - (34.36 \times 60) = 15,279 \text{ B. T. U.}$$

per minute, or:

$$\frac{15279}{142 \times 2000} \times 60 \times 24 = 77.47$$

tons of melting ice per day. Line 9 should read:

$$\frac{1}{10.42} \times 2 \times 50 = 2 = 12.18 \text{ lbs. of liquid ammonia.}$$

The latent heat of ammonia at 100° being 491.5, gives:

$$(491.5 \times 12.18) - (125 \times 12.18) = 4463.97 \text{ B. T. U.}$$

per minute, or:

$$\frac{4463.97}{142 \times 2000} \times 60 \times 24 = 22.6$$

tons of melting ice. EDWARD C. POST, M. E.

MR. RICHMOND AGAIN.

To the Editor: I wish to say a few words in support of Mr. Geo. Richmond's remarks in the January number, on T. A. S.'s question in the December issue.

The question, as I understand it, is: *How much ice* the given compressor will make? not what its theoretic capacity is!

The first point to be considered is, What shall the temperature of the *brine* be (supposing a can system). I will not endeavor to demonstrate the most economical temperature for that purpose, but will assume it at 20° F. (Lower temperatures are generaly employed.)

To produce 20° brine, the (back) pressure of the ammonia in the expansion coils will be (according to Wood) 47.95 pounds (absolute), less the losses due to specific heat of brine and radiation through pipes, which will probably require 5° F. additional, leaving the temperature of ammonia in coils at 15° F., corresponding to a pressure of 42.93 pounds absolute or 28.2 pounds gauge. One pound of ammonia at 42.93 pounds pressure occupies a space of 6.46 cubic feet.

The compressor under consideration (12×24×70 R., double acting) has a cubic capacity of $.5^2 \times 3.1415 \times 4 \times 70 = 219.9$ cubic feet.

$$\frac{219.9}{6.46} = 34 \text{ lbs. of ammonia per minute.}$$

The condensing temperature I will assume at 70° F. The latent heat of ammonia at 70° F. is 511.52 B. T. U. This gives 511.52×34 = 17,391 B. T. U. to be absorbed per minute: from this must be deducted the amount of heat to be abstracted from the thirty-four pounds of liquid ammonia at 70° F. to gaseous ammonia at 15° F. 17,391 —(34×55) = 15,521 B. T. U.

$$\frac{15.521}{142} \times 60 = 6.551 \text{ lbs. of ice per hour.}$$

As yet no allowance has been made for clearance in compressor; if this is taken at 5 per cent, the amount will be reduced to 6,224 pounds.

Further, we must allow for losses due to radiation in brine tank, circulating pump, connecting pipes, etc., about 10 per cent, leaving the freezing capacity at 5,600 pounds.

This would be the ice freezing capacity of the machine if the water to be frozen had a temperature of 32° F. Having assumed the condensing temperature at 70° F. it is but fair to also assume the temperature of the water to be frozen at 70° F. which must be reduced to 32° F. by the machine. This work is: 5,600×38 = 212,800 B.T.U. = 26.7 per cent of the capacity of the machine.

5,600 less 26.7 per cent = 3,429 pounds of ice per hour = 41.14 tons per day for the capacity of the machine.

This I would consider A 1 performance for a machine of the size assumed, and in my opinion is at least 10 per cent above that of any machine working to-day.

EDWARD C. POST, M. E.

[*Written for* ICE AND REFRIGERATION.]

THE ABSORPTION MACHINE.

ITS PRESENT STATUS AND FUTURE POSSIBILITIES—A THEORETICAL AND PRACTICAL DISCUSSION OF THE MERITS AND CAPABILITIES OF THE ABSORPTION MACHINE.

BY JOHN E. STARR, M. E.

(*Continued from February issue, page 97.*)

In order to clear the ground somewhat before taking up *seriatim* the considerations involved in the construction and performance of the absorption machine, it may be well to glance briefly at the practical losses that are met with in the operation of refrigerating machines.

In discussing each type of machine, we will omit the loss between the coal and the delivery of the heat into the steam pipe in the shape of dry steam, as such considerations affect both types equally, with some minor exceptions hereafter referred to. In both styles of machine, after the delivery of the power to the machine in the shape of steam, there occurs unavoidable loss and dissipation of energy. A machine that would even take up a heat unit in a refrigerator of practically low temperature for each heat unit delivered by the boiler, would be considered a splendid apparatus; while from a purely theoretical standpoint the refrigerating machine of the future ought to run on the heat it takes up from the refrigerator alone. This machine may come in some mechanical millennium, but at present the engineer has to recognize certain losses as practically inevitable, and bend his energies at first to minimize them.

The losses met with in the compressor are principally:

Losses by clearance and condensation in the cylinder of the steam engine.

Prejudicial resistance of the large moving parts of the steam engine and compressor.

Loss of heat passing out in the condensing and jacket water given out in taking up the super-heat and latent heat of the gas.

Loss by reason of clearance in the compressor, and of superheating the gas in the cylinder in the suction side.

Entire loss of the latent heat of the steam (even considering feed water at 212°), compared to conditions existing in the absorption machine. This loss is either into the air by the exhaust, or in heating up condensing water, where a condensing engine is used.

Omitting a discussion of the first item, which is purely a question of steam engineering, we glance briefly at the other points:

The frictional resistance of the machinery seems to be in all ammonia compressors about the minimum of what might be expected from machinery of this type, and appears to correspond closely to a coefficient of friction of 8 per cent in accordance with Morin's laws. This seems to be fairly established by a series of tests and calculations made by Prof. J. E. Denton, in 1890, on a single-acting ammonia compressor. During these tests he obtained indicator cards from the compressor and from the engine driving it. We quote from his table of results:

TABLE I.

	No. of Test.				
	1	2	3	4	5
Horse power of steam cylinder.....	85	59.28	72.5	67.1	59.6
Horse pow'r of both ammonia pumps	65.7	46.02	54.8	51.9	46.5
Horse power expended in friction...	19.3	13.26	17.7	15.2	13.1
Friction per cent of indicated steam power.....	23	22	24.5	23	22
Coefficient of friction for external bearings which makes computed friction agree with experimental amount.....	8.8	7.38	9.15	7.8	7.35

From this it appears that with this particular machine (a "Consolidated") the power lost through friction of machinery was about 23 per cent of the total power indicated by the engine, and that this is a loss as low as could be expected in good practice in machinery of this type.

We also note the published cards of a De La Vergne 14×28 compressor, and of the steam engine driving it, in which the compressor indicated 48-horse power, and the engine 63-horse power, a loss of 15-horse power, or 23.8 per cent. Also of a 12×24 compressor of the same make, which indicated 30-horse power, while the engine indicated 42-horse power, a difference of 12-horse power, or a loss of 28.6 per cent. This machine was working at a high condensing pressure, which accounts for the greater percentage of frictional loss.

The heat eliminated by taking up latent heat of gas in the condenser is the same in both the compressor and the absorption machines, but the amount of superheat is far greater in the compressor than in a well constructed absorption machine, for reasons presently to be given.

The loss by clearance in the compressor is, or can be, reduced to a very small percentage, but a great difficulty, at least in American practice, lies in the fact that the gas entering the cylinder becomes heated and rarefied. This causes a loss of economy analogous to cylinder condensation in a steam engine, only the operation is reversed. It has also the same general effect as the reduction of back pressure. Even where the cylinder is jacketed, this loss of economy is large. In Professor Denton's tests, before referred to, after making every reasonable allowance for clearance and leakage past pistons, the difference between the weight of gas actually circulated and the weight accounted for by calculating the displacement at the density corresponding to the back pressure was 21.4 per cent.

In the compressor heat in the exhaust steam (a large percentage of its total heat) is entirely wasted, as compared to the absorption pipe. In the latter machine the steam is condensed in the generator, giving up its latent heat, and is returned to the boiler at very near boiler pressure. In many kinds of refrigerating service it may be allowed to drain back directly to the boiler, utilizing the total heat (barring radiation) and saving the power necessary to pump the feed water into the boiler. The very small percentage necessary to run the aqua pump has only to be considered. The feed water is always at a high plane of temperature. The portion of the steam utilized in heating up feed water in the compression machine, therefore, is comparatively just as much a waste as the larger portion that dissipates its heat into the air.

There is, of course, an amount of work to do in the absorption machine, and other losses not found in the compressor, that corresponds with this loss of latent heat in the compressor. The practical chances, however, of minimizing these losses are greater than are the chances of saving the loss of heat going out in the exhaust.

Furthermore, it must be always remembered that the efficiency of a compression machine is dependent on its condensing pressure, and more particularly on its back pressure, and that at the same condensing pressure a machine that would show, say, an efficiency of twenty-four pounds of ice refrigerating effect per pound

of coal, at twenty eight pounds back pressure, would only give about fourteen pounds of ice effect at seven pounds back pressure per pound of coal. At lower back pressure the rate diminishes with corresponding rapidity. The condensing pressure usually involves question of cost of water, and, generally speaking, the gain made by lowering the condensing pressure is offset by the extra cost of delivering water to the condenser to effect such lowering of pressure.

We believe that it will be generally admitted that for the production of very low temperatures a fair absorption machine will be more economical than a compressor, but as in many refrigerating requirements there can be used a temperature of evaporating ammonia as high as 14° or 15° F., the absorption machine, to be on a commercial par, must be shown to be as effective under these conditions.

It has been denied that at high back pressures the absorption machine can be made as good as the compression machine. We will try to show that as a matter of fact the conditions of pressure that affect the compressor similarly affect the absorber, and an absorption machine properly constructed and handled becomes more efficient as to coal and duty as its condensing pressures decrease, and more particularly as its back pressure increases, if a proper use of back pressure is made.

Having called attention to these items for the purpose of future comparison, we turn to a discussion of the conditions affecting the performance of the absorption machine:

The writer had his attention called to these conditions during the developing of refrigerating machinery for special service in street pipe line refrigeration. On account of the enormously unsteady refrigerating load, a compression machine for this work was entirely out of the question, while the absorption type admitted of modifications that rendered it peculiarly adapted to the service, as it admitted of storing anhydrous ammonia ahead, to account for the irregular demand; and, what was of far greater importance, it allowed the reception and storage of return gas in a surplus storage of aqua, so that within the limits of reasonable space and of the greatest variation of refrigerating load found in actual practice, the process of distillation and compression could go on at a constant rate without varying the condensing or back pressure. After the numerous problems attendant on the construction and operation of the pipe line were solved, closer attention was naturally turned to the economies possible in the refrigerating machine. An absorption machine of the usual type, aside from the modifications above mentioned, was in use. A careful investigation showed that it was about as good as the run of machines under modern practice, but this did not seem to be any very great advance on the Carré or Reece machine of many years ago. At the outset we were confronted with the conspicuous absence of data mentioned in the beginning of these papers. From a theoretical standpoint, Ledoux arrived at "this remarkable result; that in all the ice machines, when they worked between the same limits of temperature, the theoretic quantity of negative heat produced is exactly the same for each caloric expended, whether it is directly produced by chemical action, or indirectly under the form of mechanical work." "But," he goes on to say "as a caloric represented by 424 kilogrammeters costs in the best heat motors an expenditure of at least ten calorics in the fire, it would seem that the chemical machines possess a considerable advantage over all others, since in these latter the heat is employed directly and not under the expensive form of mechanical work. Practically, however, this advantage is much less than that which seems to result from the above calculations"—which he proceeds to show. But though from the state of the practice at that day he makes out a high efficiency for the absorption machine, it is clear that he omits some of the most important considerations involved, and, for want of proper data, is obliged to grope in the dark at other points. For example, he had only for the heat of solution the single experiment of Fabre and Silbeman at low pressures, and assumed this to be the same, without regard to pressure or *strength of solution*. He was then obliged to assume that the heat of disassociation was the same for all pressures, without regard to strength of solution. No data of the pressure and temperature of various strengths of solution were at hand.

We fail to understand how a machine could be constructed with any hope of realizing the possibilities of the type without such data; and, as before observed, in the light of the absence of this knowledge and of the great and exact amount of material in existence bearing on compression machine construction, it is a wonder that there are any absorption machines in existence to-day. All the literature on the subject is strangely silent on those points. Published lists on absorption machines scarcely refer to the character of the aqua solution, which is really the basis of practical calculation, not only as to the construction and dimensions of the machine, but as to its economical operation, both in respect to the use of coal and water.

In developing the machine before referred to, the writer was compelled to make a large number of experiments to attempt to supply the missing links in the chain of knowledge, and the results of these experiments, rough as they are, together with the practical work of the machine, led to these general conclusions:

The efficiency of the machine depends, among other things:

First—On the initial strength of aqua solution, since

(*a*) *The heat required for disassociation of the ammonia from the water is less as the solution is stronger.*

(*b*) As the solution is stronger as it leaves the absorber, the amount of "dead" weak ammonia to be handled becomes less, reducing the work required of the heater, the generator and the aqua pump.

(*c*) The gas can be made more nearly anhydrous when the entering solution is stronger, without the waste of heat or water.

Second—On the amount of cooling water, since, as the amount of cooling water is increased the condensing pressure is decreased, requiring less work to compress the gas (as in the compression machine), and furthermore the strength of the solution can be increased without raising the back pressure.

Third—On the amount of back pressure, since by using the same amount of water, but allowing an increase of back pressure, stronger solutions can be obtained, which increases both the output and the efficiency of the still.

Fourth—If an absorption machine is run at the same back pressure and condensing pressure as a compression machine, it need not, if rightly constructed, use any more water than the compressor giving the same economic results.

These conclusions, if correct, throw a large share of the burden of the success of the machine on the construction and method of handling the absorber. An examination of the absorption machines of the present day shows that the absorber is generally the weakest point of the machine. Very few absorbers exhibit any attempt to take advantage of the low pressures of weak solutions to take out heat at high planes of temperatures and the small range of the temperature and large amount of cooling water used in the absorber of most machines are almost painful exhibitions of lost opportunities.

Let us consider, then, carefully, the conditions affecting the process of absorption as the point for breaking into the cycle of operations involved in refrigerating with an absorption machine.

We will consider the work involved in absorbing 100 pounds of NH_3 into a solution coming from the still, or exchanger, containing 10 per cent of NH_3 and 90 per cent of water (16 Beaumé), arriving at the absorber at a temperature of 105° F. This solution is to receive the 100 pounds of NH_3 up to a point where it becomes a solution containing 38 per cent of NH_3 and 62 per cent of water, and the back pressure on the return gas is to be twenty-five pounds above the atmosphere, corresponding to a temperature in the refrigerating coils of 12° above zero F. The cooling water is assumed to have at first been used in condensing 100 pounds of NH_3 in the condenser, and its temperature when first pumped on the condenser, taken at 56, condensing pressure 150 pounds, allowing two gallons of water per pound of ammonia, which is an equivalent of three-fourths of a gallon of water per minute per ton of ice melting effect per day. We must first consider what would be the temperature of the cooling water under these conditions when it arrived, ready to do work, at the absorber. The total heat to be taken from each pound of ammonia in the condenser, under these conditions, giving a liberal allowance, would be about 650 B. T. U. The condensing water would be, therefore, raised to a temperature equal to $\frac{100 \times 650}{2 \times 8.34 \times 100} + 56 =$ a temperature of 95° F.

Leaving out of present discussion the question of the heat of absorption under various conditions of temperatures and strengths of solution, and taking it at 925 B. T. U. per pound of NH_3 absorbed, which will be admitted as the outside, we will ascertain if the 1,668 pounds of water coming to the absorber at 95° F. will take care of the heat of absorption of 100 pounds of NH_3 under the conditions mentioned, without raising the back pressure above twenty-five pounds.

We again bump up against the lack of data before complained of. The specific heat of aqua ammonia solutions of various strengths has either never been determined or is carefully concealed. We have calculated it approximately for various strengths, but the results are not checked by experiments, and we prefer for the present to consider it for all strengths the same as water, as the calculation would not be materially affected.

Fortunately, however, for the present purpose, we have at hand a full set of curves prepared from a large number of experiments made by the writer, giving the temperatures of all strengths of aqua ammonia from 1 to 40 per cent strong, and from the atmosphere to 180 pounds above. Selecting from these curves the one exhibiting the temperature which will raise each percentage of solution to a temperature of twenty-five pounds above the atmosphere, we tabulate the results at 5 per cent intervals.

TABLE II.

Temperature of solutions of ammonia in water of strengths from 2 per cent to 38 per cent. at a constant pressure of 25 pounds.

SOLUTION.		Temperature, Fahrenheit.
Per cent water.	Per cent NH	
98	2	258.8
95	5	242.7
90	10	227.5
85	15	194.2
80	20	173.7
75	25	155.7
70	30	139.6
65	35	126.
62	38	119.25

It will be seen from this table that in an absorber constructed in a manner allowing the cooling water to take up heat progressively through the range of temperature from strong to weak solution, and if the aqua gradually increasing in strength is allowed to flow against or counter-current to the cooling water from weak to strong at a regular decrease of temperature, the theoretical range of the cooling water, if the weak aqua was initially a 10 per cent solution, would be from 95° (supra) to 227.5° F., or a range of 132.5°, and it would allow the original incoming solution to rise in tempera- to 119.25° F.

If 100 pounds of NH_3 were absorbed into a 10 per cent solution, the amount of water would be 199.289 lbs.
The NH_3 in the 10 per cent solution would be, 22.143 ··
Weight of the 10 per cent solution would be..221.432 ··
The 100 pounds absorbed.....100.000 ··
Weight of 38 per cent solution would be....321.432 ··

The 10 per cent solution entering at 105° would be allowed to rise to 119°, and would take up heat of absorption to the amount of 119°—105×221.432= 3,100 B.T.U.

The total amount of heat of absorption to be taken up by the cooling water would, therefore, be (100×925) — 3,100 = 89,400 B.T.U. The possible range of temperature of the cooling water is from 95° to 227.5°, or 132.5°. Hence, the amount of water necessary to take up the heat would be $\frac{89,400}{132.5}$ 674 pounds, or only about 40 per cent of the amount available. If 1,668 pounds of water were used (.75 of a gallon per minute per ton per day), the range in such an absorber (omitting the aid given by the cooling work of the 10 per cent solution) would be $\frac{925 \times 100}{1,668} = 55°$, which would raise the cooling water from 95° to 150°. Now, the pressure of a 38 per cent solution at 95° and a 10 per cent solution at 150° is less than twelve pounds above the atmosphere, so that the absorber might be run at that pressure, instead of twenty-five pounds, if the total amount of water was used, making the machine available for temperatures in the expansion coils of 5° below zero F. These figures represent, of

course, an almost perfect arrangement of heat exchanging surfaces, involving great care in construction. Also, it must be remembered, that as the exchange of heat involves the use of a greater amount of surface as the temperatures to be exchanged are nearer to each other, the cost of providing the surface to realize the exchanges of temperature above mentioned might as a commercial consideration be higher than would be compensated for by the superior results. It is, however, of the utmost importance to maintain the highest possible strength of solution, and as the margin between the theoretical result as to water (674 pounds, as above), and the amount assumed to be available (1,668 pounds) is so very great, it will be apparent at a glance that a practical application of the figures can be made well within the limits of the conditions given and the results expected. We will give an illustration of the practical results attainable entirely within the limits of simple construction, low first cost, and reasonable floor space.

Instead of a perfectly progressive rate of taking up heat as the strength of solution increases, we group the strength of solution and the amount of NH_3 absorbed into each strength into periods at the intervals shown in Table II. and tabulate the results, allowing the water to leave each group at least 20° below the mean required temperature of the aqua.

TABLE III.

Range of cooling water entering absorber at 95° F., at the rate of .75 gallons per minute per ton refrigerating per day, with absorbing surfaces proportioned for twenty-five pounds back pressure, arranged to realize a practical range of temperature of cooling water, and to absorb 100 pounds of NH_3 into a 10 per cent solution, and to discharge a 38 per cent solution. Under these conditions, 1,668 pounds of water from the condenser are available. No allowance made for rise of temperature of incoming weak aqua, or for effect of using available pressure of weak aqua to draw in the gas by inspirations. For sake of clear illustration, the amount of gas absorbed into various strengths of solution are arranged in groups, water counter-currents from strong to weak:

1	2	3	4	5	6	7	8	9	10	11	12
Group.	Temperature of highest strength in group.	Temperature of lowest strength in group.	Mean temperature of second and third columns.	Pounds of NH_3 absorbed.	B. T. U. given to water 0.25 × pounds N H_3.	Cooling water raised in temperature degrees F. Col. 6 ÷ 1,668	Temperature of cooling water entering each group.	Temperature of cooling water leaving each group.	Mean temperature of Column 8 and Column 9.	Difference between Columns 4 and 10.	Square feet of surface per 100 pounds, per hour.
38 A to 35	119.25	126.00	122	14.85	13,736	8.23	95.00	103.23	99	23	12
35 B to 30	126.00	139.6	132	21.90	20,257	12.14	103.23	115.37	109	23	17
30 C to 25	139.6	155.7	147	18.96	17,539	10.51	115.37	125.88	120	27	13
25 D to 20	155.7	173.7	164	16.71	15,457	9.26	125.88	135.14	130	34	9
20 E to 15	173.7	194.2	183	14.56	13,468	8.07	135.14	143.21	139	44	6
15 F to 10	194.2	227.5	210	13.02	12,043	7.22	143.21	150.43	146	64	4
Total 38%.....				100.00	92,500	55.83	.....	.....	.....	...	61

NOTE.—Column 12 is computed on the basis of an exchange of fifty B.T.U. per square foot per hour per degree of difference of mean temperatures. No account is taken of the variation of heat of absorption. The strengths of solution, of course, blend into each other in regular progression, instead of by periods, as shown.

It must not be taken that a 38 per cent solution is the highest possible obtainable in the absorber. The considerable margin over the allowable range shown in reserve by the table may be used in several ways to meet special conditions.

Less than the given amount of water might be used, increasing its range. The balance could be used, if desired, for other purposes, such, for example, as supplying deficiencies of the exchanger.

Less water might be used on the condenser, so increasing condensing pressure at expense of fuel (as in compressors). This would bring the cooling water to the absorber at a higher temperature and raise the whole plane of taking up heat.

More water might be used, increasing strength of solution, and diminishing coal cost for condensing and for disassociation, or to diminish the back pressure. Increasing the surface on the same amount of water would either increase the strength, or decrease the back pressure on the same strength. An increase of 25 per cent on the surface would lower the back pressure to about fifteen pounds.

An increase of water on the condenser, so that it would reach the absorber at 80° F., would reduce the back pressure to four pounds, giving the same strengths.

We are aware that in some machines the weak aqua coming to the absorber at the generator pressure is used to inject the gas into the absorber, thus allowing the absorber to run at higher pressures than the pressure in the expansion coils. The result aimed at, however, seems to be more for the sake of lowering back pressure than to attain high strengths of solution, as the absorbers are not constructed to reap the full benefit of the inspirator, and there is a limit to the possible use of the inspirator very quickly reached when very strong solutions are sought, as the amount of weak aqua diminishes as the solution required grows stronger.

The main defect in most absorbers found in use today lies in the common and pernicious form of construction that keeps the aqua about as strong at one point as at another, and does not allow progression of temperature of the cooling water toward the weaker solution. They are practically nothing but a cylinder with cooling coils inside, and the heat is taken out without the slightest regard to economy of water or attainment of the highest strengths at the lowest back pressure.

The range that it is possible to give the cooling water, even at the moderate strengths attained, is ridiculously small. The surface is generally used in very much the same manner as in exhaust steam feed water heaters—the constructors failing to recognize that the conditions are entirely different. In the feed water heater, the temperature is constant on one side at every point of the surface. In a properly constructed ammonia absorber, the temperatures can be easily made to pass each other from cold to hot on one side of the surface, and from hot to cold on the other side.

We repeat that the absorber is the keystone of the machine, and it is the failure of many makers to recognize the economic possibilities in its construction that has cast on the absorption machine in general the stigma of being an enormous consumer of cooling water, and has rendered it impossible to realize the fuel economy easily possible. We have laid special stress on the subject of absorption. The object in doing so will appear more plainly as this discussion continues.

(TO BE CONTINUED.)

[*Written for* ICE AND REFRIGERATION.]

AMMONIA COMPRESSION MACHINES.

A METHOD PROPOSED FOR SOLVING THE PRACTICAL PROBLEMS OF REFRIGERATION BY MEANS OF A DIAGRAM AND SLIDE RULE—A STUDY OF COMPRESSION MACHINES.

BY GEORGE RICHMOND, M. E.

THE object of this article is to indicate a means of solving, by mere inspection of a diagram, or simple arithmetical processes based thereon, many of the practical problems connected with refrigeration. In other words, with the aid of a slide rule and a diagram such questions as, "Capacity of a machine under different conditions?" "Horse power per ton?" "Refrigeration per ton of coal?" "Cost for fuel per ton of refrigeration?" etc., can be answered with close approximation.

The discussion relates throughout to the general principles of refrigeration common to all styles of compression machines; and care has been taken, not only to avoid the question of the merit of any particular construction, but also to exhibit the processes in such a manner as to make the results easy of verification.

It is believed that the method can be made very effective for its purpose if properly arranged; and the writer would be glad to receive the coöperation of those actually engaged in handling machines in improving the form, and particularly in collating data resulting from authenticated tests, so that where empirical modifications of purely theoretical deductions become necessary (in order to adapt them to conditions of actual practice), these may be based on the widest possible range of experience.

The volume of the compressor being the only fixed quantity, the fundamental unit chosen is a cylinder of unit volume, namely, one cubic foot.

It is a matter of common observation that the refrigerating effect of a given machine diminishes as the temperature in the expansion coils is lowered, or, what amounts to the same thing, as the return pressure falls. One reason for this is, that the refrigerating effect of any machine depends on the *weight* of ammonia passed through the system by it in a given time; whereas a compressor, running at uniform speed, passes around a fixed *volume* of gas per hour or per day. Since a cubic foot weighs less at a lower temperature and pressure than at a higher, the refrigerating effect of the machine will diminish as these are reduced. Other circumstances, as we shall subsequently see, also tend to decrease the efficiency as the temperature falls.

In the diagram the curve marked "Amount of Refrigeration" represents the variation in refrigerating effect as the machine is run at different temperatures. On the base line are marked the temperatures in the expansion coils, and (below them) the corresponding gauge pressures. The temperature inside the condenser coil is supposed to be 80°, corresponding to a pressure of about 140 pounds on the gauge. A different curve would have to be drawn for each condenser temperature. The general character of all of these would, however, be the same, and differ very little in position, so that the curve as drawn will apply pretty closely to a large number of cases occurring in actual practice. The height of any ordinate drawn to the curve from any number on the scale of temperature at the base, represents the amount of refrigeration at that temperature. It is evident that the rating of the machine will vary with the temperature selected. If we choose a temperature of 15° in the coils (corresponding to a gauge pressure of about 27) as the standard for rating the machine, and consider that the ordinate A B represents 100 tons, or 100 per cent of refrigeration, then the other ordinates will represent in tons, or in per cent, the amount of refrigeration at any other temperature. For example, at 5° the height of the ordinate is 8 divisions, representing eighty tons, or 80 per cent, as compared with the standard. On the other hand, an ordinate to the left of A B, say that for a temperature of 30°, is 13.5 units long, representing refrigeration equivalent to 138 tons, or 38 per cent above the standard.

The method of calculating this curve is very simple. If we suppose a compressor to have a volume of exactly one cubic foot, then its capacity will vary as the refrigerating capacity of one cubic foot of ammonia under different conditions. The refrigerating effect of one pound of ammonia is equal to its latent heat less the heat carried from the condenser into the refrigerator, hence the refrigerating effect of *one cubic foot* of ammonia is equal to the above amount multiplied by the *weight* of one cubic foot. That is:

$$R = [L - c(T_1 - T_2)]\, d \qquad (1)$$

in which

R = the refrigerating effect of one cubic foot of ammonia.

T_1 = temperature of condenser.

T_2 = temperature of refrigerator.

L = the latent heat at this temperature.

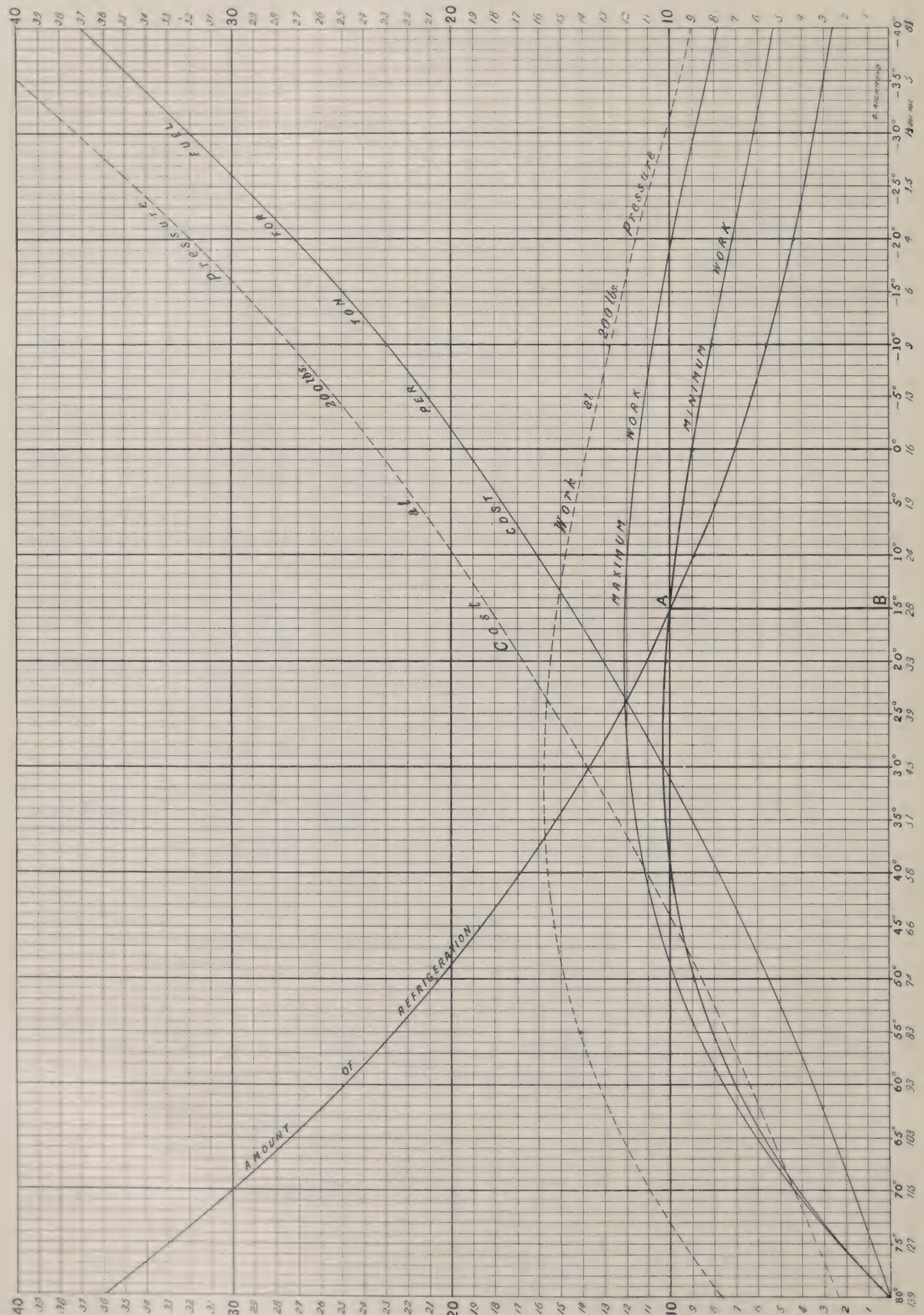
d = the density of the ammonia, *i. e.*, the weight of one cubic foot.

c = specific heat of liquid ammonia, which will be taken as equal to 1, since this simplification makes an error of less than 1 per cent in positive results, and is inappreciable in comparative results.

Twenty-four ordinates were calulated from this formula; and before plotting the results were all changed proportionally, so that at 15° the curve should pass through the tenth division. By so doing this temperature is made the standard, and the change in capacity for any different temperature can be read off at once as a per cent of this standard. This standard is perfectly arbitrary, and chosen only as a matter of convenience. Finally, the unit was changed from thermal units per minute to tons refrigeration per twenty-four hours, so that if absolute results are required, each vertical division represents .03775 tons of refrigeration daily for every cubic foot passed through the compressor per minute.

The tables used in constructing the refrigeration curve are those of Professor de Volson Wood, as published in his "Thermodynamics" third edition.*

* Since the writing of this article the tables of Prof. Wood have been reprinted in ICE AND REFRIGERATION, and the method of finding the value of R may be illustrated by reference to the same. In the table, p. 110, Vol. II, the fourth column gives the value of L and the last column those of


AMOUNT OF REFRIGERATION
PER TON
COST
WORK
MAXIMUM WORK
MINIMUM WORK
PRESSURE
200 lbs.
200 lbs.
A
B

These were chosen as being the most accessible data in English units. The reader can easily construct the curve in accordance with any tables he may prefer. The assumption of the value (1) as the specific heat of liquid ammonia is probably incorrect: Dr. Strombeck found this to be 1.23 nearly (*Journal Franklin Institute*, December, 1890), which would cause the curve to fall closer to the base line—the ordinate for 15° becoming 9.7 instead of 10, and that at —15° 5.35 instead of 5.6. The latent heat, however, as found by Dr. Strombeck, is higher than in Professor Wood's tables, which would tend to restore the curve to its original position.

The refrigeration curve has been drawn on the supposition that the gas, when it fills the compressor, is neither superheated nor mixed with liquid ammonia. It may be shown that this condition gives the maximum refrigeration for a compressor of fixed volume. If the gas is superheated the equation to the curve is:

$$R = [L - c(T_1 - T_2) + c_p(T_3 - T_2)]\, d' \qquad (2)$$

in which T_3 is the temperature to which the gas is superheated, d' is the density of the superheated gas, and c_p its specific heat. The superheating of the gas is a gain in refrigerating effect, provided it has been done in the cold rooms or in the brine tank and not in the engine room; but the reduction in density more than compensates for this advantage. If the gas contains liquid ammonia in suspension, the equation to the curve is:

$$R = [L - c(T_1 - T_2)]d - cy(T_1 - T_2) \qquad (3)$$

in which y is the weight of liquid ammonia contained in a cubic foot of the mixture, and neglecting the small reduction of volume due to the presence of the liquid ammonia: (3) is evidently less than (1), since the last term which it contains represents the amount of heat carried into the refrigerator from the condenser by the weight y of ammonia, where it is cooled down and passes out in a liquid form without producing any refrigerating effect. Curves (2) and (3) would differ very little from (1) which alone will be considered in this paper.

This curve may be used to illustrate many important facts of refrigeration; and by its means quite a number of interesting problems may be solved at sight or by simple measurement.

1. It is plain that a machine should be run with the highest temperature in the refrigerator (or the highest back pressure) that circumstances permit.

2. That if refrigeration is to be performed under widely differing circumstances of temperature, either two machines should be used or the machine should do each class of work separately. For example, if a temperature of 10° is required in one part of the premises while a temperature of 30° (say for cooling water) may be used in another part, the refrigerating effect in the first case is 89 per cent, and in the second 135 per cent of the standard. So that if the machine is doing both at the same time, its performance on the latter work is only 66 per cent of what it is capable of under suitable conditions.

3. It is perfectly clear that reports of tests of capacity are of no value whatever unless the conditions of temperature and pressure under which they are made are explicitly stated.

4. By suitably changing the conditions a machine may be shown to perform any desired amount, either greater or less than its rated capacity. Suppose, for example, a machine is rated at 100 tons at a temperature of 15°: to give a performance 50 per cent above this, we select a point on the curve where the ordinate is equal to 15, that is at a temperature of about 34°. To show 50 per cent less than the standard, we select a point on the curve for which the ordinate is 5, corresponding to a temperature of —15°. In the first case our 100-ton machine would give 150 tons, and in the latter fifty tons refrigeration capacity, and this would result from circumstances over which neither the builder nor the engineer in charge could have any control.

5. The diagram may also be used to indicate the conditions under which it is possible to store up a supply of cold in brine tanks. It is frequently assumed that if fifty tons refrigeration is required, a 100-ton machine working twelve hours a day will be equivalent to a 50-ton machine working twenty-four hours. This would be true only in the case of a brine tank of infinite magnitude, so that in the process of storing cold the temperature would not fall, which is manifestly impossible. We see that as the temperature falls, so also the productiveness of the machine falls. Suppose the brine is allowed to drop 10° for purposes of storage, the 100-ton machine becomes one of eighty tons only. When the brine falls 10° lower, the machine is doing an equivalent of only sixty-three tons. If fifty tons is required in the brewery, the surplus for storage is now only thirteen tons.

The application of this diagram to the solution of some practical problems will now be considered.

1. Given the capacity of a machine at one temperature or back pressure, what is its capacity at another one? The capacity is proportional to the height of the corresponding ordinates.

Example 1.—A machine shows a capacity of seventy-five tons at a temperature of 20°; what will be its capacity at 0°?

The ordinates corresponding to 20° and 0° are 11 and 8 respectively, hence

$$11 : 8 :: 75 : x$$

$$x = \frac{8 \times 75}{11} = 54.5 \text{ tons.}$$

Example 2.—The capacity of a machine working with a back pressure of nine pounds is forty-seven tons; what is its capacity when the back pressure is twenty-eight pounds?

The ordinates corresponding to nine and twenty-eight pounds are 5.6 and 10 respectively, therefore

$$5.6 : 10 :: 47 : x$$

$$x = 84 \text{ tons.}$$

Example 3.—A machine is rated at forty tons, with a back pressure of 28 and making fifty revolutions per minute; what must be the speed to produce the same result with a back pressure of 16?

The speed will vary inversely as the rate of refrigeration. The ordinates for the pressures 28 and 16 being 10 and 6.3 respectively,

$$6.3 : 10 :: 40 : x$$

$$x = 63.5, \text{ say } 64 \text{ revolutions per minute.}$$

Example 4.—A machine has a capacity of 100 tons when the brine has a temperature of 25°. If, by continually running, the brine can be held at —5°, how much

d. To find R, for example, when the condenser temperature is 80° and that in the expansion coils is 15°,

$$R = [L - c(T_1 - T_2)]\, d = [546.26 - (80 - 15)] \times .1547 = 74.45 \text{ T. U. per min.}$$

$$\text{or, } R = \frac{74.45 \times 60 \times 24}{142 \times 2000} = .3775 \text{ tons per day} = AB.$$

Since AB is divided into 10 equal parts each division = .03775 tons per 24 hrs. In using this table the reader must be on his guard against certain errors which have crept in, but which can be readily detected and rectified.

refrigeration is actually being utilized in the buildings?

Allowing a difference of 10° between the temperature of the brine and that of the ammonia in the coils, the corresponding temperatures are 15° and −15° for which the ordinates are 10 and 5 respectively. Therefore—

$$10 : 5 :: 100 : x$$
$$x = 50 \text{ tons.}$$

or the machine is twice as large as the requirements call for, if brine at 25° will serve the purpose.

2. Given the size and speed of a compressor, to find its capacity at any selected back pressure. To solve this we have only to multiply the volume passed through the compressor per minute in cubic feet by the height of the ordinate at the chosen temperature, and by the number .03775, and the result will be the capacity in tons per day.

$$C = V \times R \times .03775 \qquad (4)$$

in which C = the capacity in tons per twenty-four hours, V = the volume per minute passing through the compressor, and R = the height of the ordinate representing the rate of refrigeration.

Example 5.—A 12×24-inch double-acting compressor runs at forty revolutions per minute: what is its capacity at 20°?

Here $V = 125.7$, and $R = 11$, hence

$$C = 125.7 \times 11 \times .03775 = 52 \text{ tons.}$$

In the practical application of this formula it should be remembered that the assumption is made that the cylinder is completely filled with saturated gas at the same pressure it has in the expansion coils: that there is no clearance and no leakage through the piston or valves. An allowance must therefore be made for the fact that none of these circumstances actually exist in practice. The amount of this allowance is more or less arbitrary, and depends on the style of the machine, the mode of running and the perfection of workmanship. It also depends on the ratio of compression, for the loss by clearance increases with this ratio, as does also the loss by superheating, since the difference of temperature of the incoming and outgoing gas is increased. If C' is the practical capacity of a machine, and m the amount of loss of effect—

$$C' = (1 - m) C$$

where m is not constant, but might probably be represented by the form,

$$m = a + \phi(c\ r\ s),$$

where a refers to influences outside of the compressor, such as superheating between the expansion coil and compressor and loss of pressure by pipe friction, while $(c\ r\ s)$ relates to influences within the compressor, c being the clearance, r the ratio of compression and s the speed, the influence of which is felt upon the wire drawing through the suction valve. It is possible that by careful experiment the value of m could be determined for a given machine. Knowing the volume of the compressor, C can be calculated, and by running the machine for a time under identical conditions and measuring the quantity of ammonia passed around, C' could be ascertained. Hence the value of $(1 - m)$ for those particular conditions is found by dividing C' by C. Proceeding thus for other conditions, we obtain a value of m for each of them. It might also be possible to separate the part a of the values thus found, when the remainder $\phi(c\ r\ s)$ would be a measure of the efficiency of the compressor as a machine. Leaving for future consideration this interesting and important question, we will for our purpose take $m = 25$ per cent, which seems to be a fair average for a limited range of temperatures when the machine is in good condition and run with ordinary care. This allowance does not affect questions relating to *comparative* results, and for positive results the reader can substitute any coefficient he thinks more suitable.

The formula therefore becomes for practical use:

$$C' = V \times R \times .03775 \times .75$$
$$C' = V \times R \times .02831 \qquad (5)$$

and the machine, in the above example, would be rated as practically furnishing thirty-nine tons refrigeration.

In calculating the capacity of a machine for varying conditions, it is convenient to first calculate its capacity at the standard rate: the others can then be obtained by percentage. In what follows all compressors are assumed to be either double-acting or to consist of two single-acting cylinders.

Example 6.—What is the *practical* capacity of a 10×30 machine running at forty revolutions (temperature 15°)?

$$C = 109 \times 10 \times .02831 = 31 \text{ tons.}$$

Its capacity at 25° = 31×1.24 = 38.4 tons.

Its capacity at 5° = 31×0.8 = 24.8: and so on for other temperatures.

3. Given the refrigerating capacity a machine is required to have at a known temperature, and the speed at which it is desired to run it, to find the volume of the cylinder.

If v = volume of cylinder, and
n = number of revolutions per minute

$$C' = .0283\ (2n)\ v\ R \qquad \text{by } (5)$$
$$V = \frac{C'}{.0283\ (2n) \times R} \qquad (6)$$

Example 7.—A machine is required to have a capacity of fifty tons, working with brine at a temperature of 10°, and making fifty revolutions.

NOTE.—The temperature of the ammonia in the expansion coil must be less than that of the brine. If a large tank is used with sluggish circulation, the difference may be 10°, which will in future be assumed in such cases.

The machine therefore must be worked with a temperature 0° or back pressure of about sixteen pounds, for which $R = 7.1$.

$$v = \frac{50}{.0283 \times 7.1 \times 100} = 2.5 \text{ cubic ft.}$$

If the stroke is to be n times the diameter we have

$$2.5 = \pi \frac{D^2}{4} n D$$
$$D = \sqrt[3]{\frac{100}{\pi n}}$$

(TO BE CONTINUED.)

THE decision in the Counselman case—that neither the railroad company giving nor the shipper receiving a cut rate can be compelled to testify and thus incriminate themselves—practically wipes out the inter-state commerce law, since, of course, it is practically impossible to secure outside testimony sufficient to insure a conviction on an indictment for violation of the law.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

∴ MARCH, 1892 ∴

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

PAYABLE IN ADVANCE.

Foreign Postage $1.00 in addition to Subscription Price.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS.

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1892, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

INDEX TO ADVERTISERS.

Ainsley, Cochran & Co.....230
Ajax Metal Co 209
Alaska Refrigerator Co.....166
American Fluoride Co.....202
Am. Ice Machine Co., of N. Y....231
Armstrong, Bro. & Co.. 212
Armstrong Mfg. Co.....203
Arnold & Co.....211
Baragwanath, Wm. & Son.....236
Bartlett, Hayward & Co., Outside Back Cover.
Billington, Jas. H. & Co.....207
Bird, F. W. & Son.....213
Bird Paper Mfg. Co.....214
Black, A. W.....167
Blymyer Ice Machine Co 232
Bodenstein, Henry.....204
Bodenstein, J. G. & Co 205
Boggs & Clarke 203
Brandt, Randolph.....207
Briggs, John N.....204
Buffalo Refrig. Machine Co.....233
Buhring Water Purifying Co.....218
Burns Mfg. Co.....223
Callahan, W. P. & Co.....233
Canton Steel Roofing Co.....208
Cardell, James D., & Co.....221
Case Refrig. Machine Co.....228
Castle Ice Machinery Co.....228
Chapman Valve Mfg. Co.....164
Cincinnati Corrugating Co.....224
Clapp, B. P., Ammonia Co..... 217
Cleveland Anhydr's Am. Works..216
Columbus Iron Works Co.....220
Conway, P. J. & Co.....167
Cook, A. D 169
Cook, E. H., Co.....202
Craft Refrigerating Machine Co. 229
Crandall Packing Co.....208
Crane Co.....205
Crosby Steam Gage and Valve Co 202
Dalzell, Jas. & Son Co.....212
Davis & Rankin B. & M. Co.....206
Dean Bros.....168
Deane Steam Pump Co.. 169
De La Vergne Refrig. Mach. Co..238
De Loach Mill Mfg. Co.....222
Directory of Ice Factories, Ice Dealers & Cold Storage Houses.204
Dixon, Jos. Crucible Co.....209
Dodge, B. G.....211
Downie Bros. & Nevin.....165
Dunlevy Sheet Iron Works.....209
Edson, Jarvis B 000
Electric Pipe Bending Co.....221
Epping, Carpenter & Co.....169
Farrell & Rempe 222
Featherstone's Sons, John.....237
Field Feed Water Purifier Co....210
Fletcher, I. D.....216
Forest City Packing Co.....207
Foster, Brown & Co.....216
Foster Pump Works.....169
Frick Co.....240, 241
Galigher, F. L.....205
Garlock Packing Co.....207
Geiger, Fiske & Co.....209
Gerlach, Peter, & Co.....204
Gifford Bros.....204
Goodrich, B. F., Co.....212
Gordon Steam Pump Co.....164
Grand Rapids Refrig. Co., The...166
Graver, Wm 206
Harrisburg Pipe Bend. Co., Ltd..220
Heerdegen & Schnee.....167
Heller, Hirsh & Co.....216
Hercules Iron Works.....163
Hendrick Mfg. Co., Ltd.....228
Hillyer, E. C. & Co.....234
Hilpert & Chandler.....167
Herf & Frerichs Chemical Co.....170
Hoppes Mfg. Co.....236
Illinois Metallic Pkg. Co.....207
Isbell-Porter Co.....227
I. & R. Binder 223
Jackson Refrigerator Co.....166
Jewell, O. H., Filter Co.....218
Johnson, McCarthy & Johnson...229
Kahnweiler, David.....212
Kendall, Edward & Sons.....206
Kenly, D. F. & Co.....208
Keystone Chemical Co.....203
Krausch Co., The Theodore.....227
Krebs, H. J.....215
Kiechler Mfg. Co.....209
Laidlaw & Dunn Co., The.....168
Lansing Iron and Engine Works.224
Lawson, Enoch.....229
Loomis Imp. Filter Co.....218
Louisville Pipe Bending Co.....218
Lunkenheimer Brass Mfg. Co.....203
McCray Refrig. and C. S. Co.....166
Mackolite Plaster Board Co.....212
Maris Machine Co 229
Maritzen, Aug.....210
Mason Regulator Co.....218
Merchant & Co 224
Miami Valley Boiler Co.....209
Miller, Jas. A. & Bro.....208
Mitchell, Thos.....216
Moyer, J. W.....215
National Am. Co., Outside Back Cover.
N. Y. Coal Tar Chemical Co.....217
Nubian Iron Enamel Co., The....202
Otto Gas Engine Works 165
Peirce, A. H. Mfg. Co.....208
Pennsylvania Iron Works Co.223, 225
Perrin, W. R. & Co.....214
Philper, H. H.....224
Phosphor Bronze Sm'lt'g Co., Ltd208
Pontifex Ice Machine Co., The...228
Pusey, Lea.....216
Queen City O. and W. Mfg. Co...203
Reading Iron Co.. 219
Reeves, Paul S 214
Reliance Gauge Co.....206
Remington Machine Co.....226
Ripley & Bronson.....165
Ripley Isinglass Co.....216
Rosengarten & Sons.....216
Samson Steam Forge Co.....219
Sauls Bros.....208
Seibel-Suessdorf C. & I. Mfg. Co..209
Severn & Caven.....217
Shipman Engine Co.....165
Smith & Vaile Co.....164
Southern Ice Machine Co.....235
St. John Cylinder Packing Co.....207
Standard Paint Co.....213
Standard Thermometer Co...168, 236
Stilwell & Bierce Mfg. Co.. 205
Stromberg, Allen & Co., Outside Back Cover.
Sulzer-Vogt Machine Co.....222
Swanitz, A. W.....205
U. S. Mineral Wool Co 214
Valley Pump Co.....168
Van Winkle Gin and Mach. Co....231
Vulcan Iron Works, The.....229
Wainwright Mfg. Co., of Mass...165
Wants, and For Sale, Etc.....202
Watson, H. F., Co.....213
Weisel & Vilter Mfg. Co..... 231
Weiskopf, A..... 236
Westerlin & Campbell.....205
Western Ice Machine Co.....230
Western Mineral Wool Co.....213
Whitehill E. and P. I. Mach. Co..239
Wilson-Snyder Co.....242
Wingate & Mell.....209
Wolf, Otto C.....Inside Front Cover
Wolf, The Fred W. Co.....170
Wood, Wm. T., & Co.....204
Woolford, Geo.....214
Wright, T. B. & Co.....203
York Mfg. Co., Inside of Back Cover

FUTURE CONVENTIONS.

The annual meeting of the Florida Ice Manufacturers' Association, E. W. Codington, Bartow, Fla., president, will be held at Tampa, March 9. No stated programme has been made out, but the proceedings and discussions will be such as the experiences of the past year may suggest.

The annual meeting of the South-West Ice Manufacturers' Association will be held on April 23. C. M. Gay, Carthage, Mo., secretary.

WHAT THEY SAY.

Our readers continue to gratify us with expressions of their good will and appreciation of the work done on ICE AND REFRIGERATION. The writers, whose encomiums we quote below, will please accept this acknowledgment of their favors:

[J. W. KENNEDY, Bastrop, Tex.]

I am delighted with your paper. It is indispensable to me. I shall take it as long as I am in the business.

[LEESBURG ICE CO., Leesburg, Fla.]

Inclosed find check for ICE AND REFRIGERATION. We cannot do without it.

[BIRMINGHAM FISH CO., W. J. HENDLEY, Prop., Birmingham, Ala.]

I like your journal very much, and have been able to find much information in the copies I have received.

[SCHOENFIELD & CO., Eggs, Poultry, etc., Jacksonville, Ill.]

Inclosed find one year's subscription to ICE AND REFRIGERATION. The paper is very satisfactory to us, and we would not be without it for four times its cost.

[T. W. ANDERSON, Houston, Tex.]

Inclosed find $2 for subscription to ICE AND REFRIGERATION. I wish, gentlemen, to congratulate you on issuing the most artistic and attractive publication I have ever seen, and bespeak for you only words of commendation.

[CHAS. J. CARY & CO., Proprietors BALTIMORE TYPE FOUNDRY, Baltimore, Md.]

Please insert inclosed advertisement in next copy of ICE AND REFRIGERATION. * * * Allow me to take the opportunity to congratulate you on the handsome typographical appearance of the paper. It is a pleasure to read and examine it.

[E. D. ROOSA, Bloomington, Ill.]

I find your paper gives much valuable information on the manufacture of ice, as well as refrigeration.

[WM. E. WORTH, Wilmington, N. C.]

I inclose herewith $2 to pay for subscription to ICE AND REFRIGERATION. Long may it live!

STUART ST. CLAIR, General Manager YORK MANUFACTURING CO., York, Pa.]

I must congratulate you on the marked excellence of your journal, and the high class of matter it contains. It will be all I prophesied it would be—the best in the country.

[J. J. CREIGHTON, Vice-President CORSICANA ICE AND REFRIGERATING CO. Corsicana, Tex.]

* * * As to the qualities of the paper, we are more than pleased with it, and no ice factory should be without a copy of it. If the owners don't read it, there is money in it for them to subscribe for their engineers, who more often have time to read, and thus improve themselves for the benefit of their employers.

[CIRCLEVILLE ICE CO., H. J. BENNETT, Manager, Circleville, Ohio.]

I consider ICE AND REFRIGERATION an indispensable journal to any dealer in either natural or artificial ice. In my own opinion, the artificial ice will supplant the natural in a very few years. I have about 25,000 tons stored now for next season, but not of the very best quality.

[THOS. SUMMERVILLE, Prop'r BUNKER HILL NURSERIES, Bunker Hill, Ill.]

Inclosed find check for $2. * * * I am very much pleased with ICE AND REFRIGERATION, and look for its monthly visit the same as I would for that of an esteemed friend.

[H. W. GERKE, Manager RIVERSIDE ICE CO., Quincy, Ill.]

Inclosed find $2 due you. * * * While you seem to lean toward the machine and machine-made ice, your paper is a welcome visitor with us.

ANSWERS TO CORRESPONDENTS.

TEMPERATURES OF BEER, ALE AND PORTER—DRYING EGGS—CALCULATION OF CUBIC CONTENTS—PURE ICE—COOLING PROVISIONS, ETC.

This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest. Correspondents, especially when asking questions of a technical character, cannot be too explicit in giving details. In stating temperatures, the kind of scale should be indicated; and in giving pressures it is well to state if pressure above that of the atmospheric pressure or above vacuum is meant. Write on one side of the sheet only.—ED.

To the Editor: Will you kindly inform us at what temperature brewers and liquor dealers prefer to keep beer, ale and porter? G. T. B.

ANSWER.—If you had specified your wants more definitely we might be able to give you a more definite answer; as it is, your question is subject to a number of interpretations. Brewers of lager beer try to keep the temperature of their storage vaults as near to 32° F. as possible. The vaults of ale and porter breweries generally have a temperature of about 55°. However, if these beers are of good condition and well worked out, their storage at a lower temperature would doubtless insure greater stability still. Similar conditions should obtain with a liquor dealer, for such beers and ales which he keeps in casks simply for storage; but such temperatures would not apply if the casks were on draught, that is, tapped for immediate consumption. In this case, both for beer and ale or porter, the temperature should never be below 52° F., and while we are aware that in many places beer is kept on draught at a much lower temperature, and also that some people prefer to obtain their drinks at such low temperatures it is, nevertheless, in our opinion, better, healthier and more conducive to a good flavor to dispense them at a higher temperature, say between 57° and 61° F. These temperatures apply also for bottled goods intended for immediate consumption. For the simple storage of bottled goods the question is whether they are prepared for storage or for immediate consumption. If they are intended for immediate or house consumption and yet are expected to keep surcharged for any length of time, they must be kept at 34° F., or even slightly below. If such goods, however, are prepared for storage for export, as it is technically called, they can be kept at a much higher temperature, but even in this case temperatures exceeding 70° are not desirable. Again, sometimes beers are bottled with a view to have them undergo a slight after-fermentation in bottles in order to produce additional life; in that case they may be exposed to a higher temperature, say about 60°, for about a week or so in order to hasten the process, but this accomplished they should then be stored cold to arrest any further changes until they are consumed. Goods treated in this manner always have a slight sediment.

To the Editor: There is, we understand, a method of preserving eggs by drying them. Can you give us some information as to how it is carried out, and with what success? T. F.

ANSWER.—Formerly the contents of eggs were dried after being mixed with sugar or salt, but it seems that no great market was found for the article; later on, we understand, the same process was carried on without any additions, but we do not know with what success. The contents of the eggs were dried as a whole or the white and the yellow were dried separately. The drying is done on glass or steel plates which are placed on frames in a drying room, and exposed to a hot air current having a temperature not exceeding 140° F., as above that temperature the albumen would coagulate and be rendered insoluble. It is stated that the substance of the eggs, carefully dried, can afterward be used for baking and other purposes in the same manner as ordinary eggs if dissolved with water, but in case it is desired to beat to a foam, it must be mixed with some fresh white of egg. There are also some patent processes for the purpose of drying the egg substance: in some of them a vacuum is used to expedite the drying.

To the Editor: Can you give us a formula by which we can calculate the cubic contents of a conical tub, the head and bottom of which are ovals? G. Z.

ANSWER.—The cubic contents, C, of such a tub may be calculated after the following formula:

$$C = \frac{\pi}{6} h \left[2(a\,b + a'\,b') + a\,b' + b\,a' \right]$$

in which a and b are the radii of the larger oval and a' b' the two radii of the smaller oval, while h is the vertical distance between the top and bottom of tub.

To the Editor: We have heard a great deal about the purity of the water obtained by passing the same through a so-called Pasteur or Chamberland filter; cannot water obtained through such a filter be used to make pure ice? G. S. P.

ANSWER.—Yes, we think that a pure ice can be made in this way, but have doubt as to its being very clear, that is, free from air bubbles.

To the Editor: In regard to cooling ice boxes I would be much obliged to you if you would give me some figures about the amount of B. T. U. required for freezing or cooling meat, eggs, vegetables, cream, etc. I suppose that the specific heat of all these substances is much different from that of water.

W. B.

ANSWER.—It makes considerable difference whether the substances you mention are to be cooled down simply to the freezing point or whether they are actually frozen. Some of the substances you mention would deteriorate by being actually frozen, and all of them can be cooled below 32° F. without becoming chilled. As regards the specific heat of the articles mentioned, it is, as you surmise, different from that of water, but we are unable to find reliable experimental data on this subject. Approximately, however, the specific heat of those materials may be inferred from their composition. These substances contain on an average about 70 per cent of water, and as their specific heat cannot be less than that of the water within them, it must at least be 0.7, the specific heat of water being taken as unity, viz., 1. On the other hand, the specific heat of these substances, taken on the basis of the above composition, cannot be much over 0.7, since the specific heat of the solids contained in them is very low, and for this reason the figure 0.75 would be on the safe side for all of these substances which do not contain much over 70 per cent of water, as few of them would under ordinary circumstances. Taking this as a basis, the amount of B. T. U. required to cool a certain amount of these substances down to freezing point is easily calculated if the initial temperature of the articles is given. This also is not given in your case. Assuming it to be, say, 70° F., the amount of B. T. U. necessary to cool one pound of material from this temperature down to freezing (32° F.) would be:

$$(70 - 32)\ 0.75 = 28.5\ units,$$

from which you will readily see the rule applicable to any other initial temperature.

In case, however, the material is to be actually frozen, this amount would have to be augmented by the amount of latent heat to be abstracted during solidification, which being 142 B. T. U. for water is

$$142 \times 0.7 = 99.4$$

or, in round figures, 100 B. T. U. for a substance containing 70 per cent of moisture in composition. In other words, the number of B. T. U. for freezing one pound of the material mentioned would be

$$28.5 + 100 = 128.5 \text{ B. T. U.}$$

If the temperature of freezing the goods is below 32° F., another addition would have to be made, which in our case would be covered by 0.4 units for every pound of material and for every degree below 32° the freezing takes place.

These figures give the actual amount of refrigeration required for the purpose mentioned. As a matter of course, the refrigeration to cool and keep cool the ice box or ice house in which the goods are contained is a separate question.

[Mr. John E. Starr, of St. Louis, kindly sends us his views also on this topic, as follows:]

A strictly accurate answer to this inquiry could not be given without having at hand correct figures as to the specific heat of the materials to be cooled. The specific heats, as your correspondent surmises, are different from water. I am unable to find anything reliable as to the specific heat of meat, eggs, vegetables or cream, or any other articles usually placed in cold storage. As most of these articles are largely composed of water, I should think it would be at least a safe commercial rule to figure the specific heat the same as water, as on most of the substances it is probably somewhat less and so a margin of safety would be allowed. That is to say, multiply the difference between the initial temperature and the required temperature by the number of pounds. If the material is to be frozen, the difference between the initial temperature and 32° F. plus 142 would be multiplied by the number of pounds.

Thus for cooling 100 pounds of poultry from 80° F. to 40° the operation would be

$$100 \times (80 - 40) = 4000 \text{ B. T. U.}$$

If the poultry was to be frozen at just 32°, the operation would be

$$[(80 - 32) + 142] \times 100 = 19{,}000 \text{ B. T. U.}$$

If the frozen goods were to be carried at 20°, it might be safe to assume the specific heat of the frozen poultry to be the same as ice (.504) and we might figure thus:

19,000 + (100 × .504) = 19,050.4 B. T. U. to freeze 100 pounds of poultry at a temperature of 20° F.

The other figures as to work done in taking up heat coming through insulation, openings, etc., would be in the general line indicated in an answer to a query on the cost of refrigeration in your November, 1891, issue. In that article the specific heat of meat was *assumed* at .7, but I am not satisfied with the reliability of the authority I found at the time for this assumption.

It must also be remembered that a considerable amount of moisture is given off by many articles placed in cold storage during the operation of cooling or freezing, and this moisture is condensed from steam to water at the expense of the cooling agent; as it would take about 900 heat units for each pound of moisture so condensed, this feature of the work would in some cases amount to quite an item.* But there is such good reason to believe that the specific heat of the bulk of cold storage goods is below that of water that I am inclined to think that the above method of figuring will fairly cover everything, and if not a strictly accurate rule, it will be a safe one.

To the Editor: Will you kindly inform me whether there is a chemical dryer of much practical use in a refrigerator cooled by overhead ice? If so what is it? How about chloride of calcium? F. R. S.

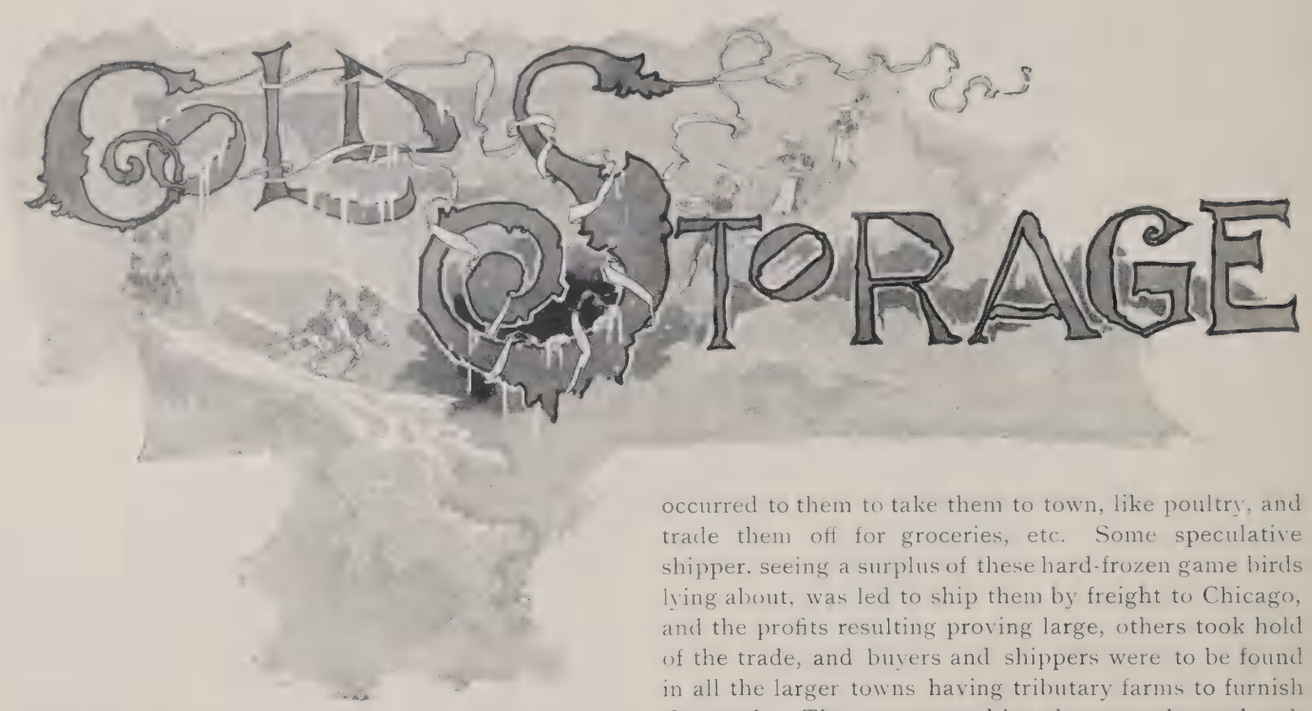
ANSWER.—If by your reference to "use" you mean the extent to which such dryers are applied, we do not think that they are used very frequently. If, however, you refer to the utility of such dryers, we should say that the efficiency of a refrigerator (the chief ultimate object is the preservation of provisions, etc.) would be improved thereby, since dry air possesses certain preserving power within itself. This would be especially so in refrigerators cooled by ice in which the temperature never reaches the freezing point. It would still be a question, however, if the expense and trouble occasioned by the application of a dryer would be outweighed by the increased efficiency of the refrigerator. As to refrigeration proper, it is by no means increased by the dryer; on the contrary, it is slightly decreased, inasmuch as the combination of the moisture with the dryer causes the evolution of some heat. Chloride of calcium is as good, if not better, for the purposes of a dryer in this connection than anything else we know of. After it is exhausted, having become saturated with moisture, it can be revived for future use by simply drying the same over a fire.

To the Editor: Is the ice or frost that gathers on the coil in chill room or refrigerating box any benefit in keeping the same cool? P. J. Z.

ANSWER.—When it is considered that ice is a very bad conductor of heat when compared with iron (its heat conductivity being 0.002 when that of iron is 0.16) and when it is further considered that a white and smooth surface radiates far less heat (and by the same token less cold also) than a black and rough surface, such as that possessed by an iron pipe, it cannot be expected that the ice forming around the refrigerating coil in refrigerator would help the cooling of the same in any way whatever. On the contrary, the cooling effect of the coils will be decidedly lessened by such frost around the pipes.

THE keeping of bait for sea fishing, as described in the issue of ICE AND REFRIGERATION for January, seems to be a complete success. One dealer at Boothbay, Me., where the herring used as bait are now procured, recently sold the whole lot of 100,000 herring that he froze and has kept in cold storage, the entire lot having been taken in four days by the fishermen, while he could have sold as many more had he had them. It is safe to say that in the future the business will be materially increased. Then the Canadians can "go to grass" with their bait, so to speak.

*We should think that the amount of refrigeration required to condense the moisture given off by the articles placed in cold storage would cut no figure in this connection, since an equivalent amount of refrigeration must be created by the very act of volatilization of the moisture in question.—[ED.



[*Written for* ICE AND REFRIGERATION.]

THE GAME TRADE.

THE PRAIRIE CHICKEN TRADE OF IOWA THIRTY YEARS AGO—HOW IT WAS HANDLED—A DEALER'S EXPERIENCE WITH GROUSE—ONE OF THE FIRST FREEZERS IN NEW YORK CITY.

By D. B. Beemer.

Thirty years ago, the game trade was restricted to shipments by express to the large markets from comparatively near-by hunting grounds, during the spring and fall migrations of the birds; Boston, New York, Philadelphia, Baltimore and Washington depending upon the gunners of the coast inlets and bays, from Cape Cod to Chesapeake bay—the latter, then, as now, furnishing that unapproachable grade of celery-fed canvas back, red head and other ducks. About that time, however, a new feature of the trade developed. Railroads were pushing their way westward across Iowa from the Mississippi river, and towns and villages were springing up at intervals along these lines, while farm settlements were developing in clumps along them to a distance of ten miles on either side. Iowa, at that time, was the banner "Prairie Chicken" state. The birds were so plentiful that they occasioned serious loss to the farmers by their marauding inroads upon the crops of small grain in the early part of the season, while later, they stripped the corn from the ear, as it stood uncut in the "hill" in the fields, as it often did, all winter.

To these corn fields in the winter time, the grouse resorted in great numbers to feed, and when alarmed would rise in such immense "packs" that the noise of their wings in their labored rising would sound like distant thunder.

But a farmer of an inventive turn of mind contrived a box trap into which the birds could readily get while reaching for feed, but from which they could not find their way out. It proved so effective in stocking the farmer's larder with fresh meat, that it soon came into general use. The "catch," however, became so large that the farmers were unable to use all the birds; and in casting about for a way to get rid of them, it naturally occurred to them to take them to town, like poultry, and trade them off for groceries, etc. Some speculative shipper, seeing a surplus of these hard-frozen game birds lying about, was led to ship them by freight to Chicago, and the profits resulting proving large, others took hold of the trade, and buyers and shippers were to be found in all the larger towns having tributary farms to furnish the stock. Thus encouraged by a home market and cash for the birds, the farmers went into the business of trapping grouse as a business by putting out large numbers of traps, which they attended much as a fisherman attends his hooks set through holes in the ice in the winter time. These traps were made of lath; were about four feet square and a foot deep; and when full would hold from two to three dozen birds. The traps being open at the bottom, where they rested on the ground, it sometimes happened that when the grouse in a trap saw a man coming toward them, they would get into such a fluttering panic that they would raise the trap bodily from the ground sufficiently for the bulk of them to escape before he could reach them.

With enlarged offerings shippers were forced to enlarge their operations. By packing the hard frozen grouse into tight barrels, they were able to reach the Boston and New York markets with them; and these markets in turn, accumulating surplus stock, reshipped quantities of them to the Liverpool English market. In the course of two or three seasons, this trade had grown to proportions which the present generation of shippers will scarcely deem possible. Cedar Rapids, on the Chicago & North-Western R. R., and Independence, on the then Dubuque & Sioux City R. R., were the largest shipping points, and often shipped grouse in car load lots, the latter sometimes making special shipments of three and four car loads of grouse at a time! Small fortunes were made—and lost, sometimes, in the trade through the risks incurred and the loss resulting from the thawing out and spoiling of the grouse while in transit, and the glutting of eastern markets by them and consequent low prices.

As an example, I will relate the experience of a man at Independence, Iowa, in 1863. He was a banker, and at the same time did a shipping produce trade, while in common with others he was buying and shipping prairie chickens. Incidentally, one day he offered a speculative curbstone operator $1.50 per dozen for what "chickens" he could bring him, intending that the offer should cover such casual lots of grouse as the other man would be able to pick up off the street. But the latter had enlarged

views upon the subject; and after obtaining the contract in writing, he drove about the country, visiting farmers and trappers and contracting with them, in turn, to pay them cash for all the grouse they could bring him, at any price he could secure below his own contract price. Then he went back and waited for his birds to come in, which they soon did—by sled loads, the sleds often being supplemented by *hay racks on them, piled high with frozen grouse!* He coolly piloted these sleighs around to the place of business of the other man and dumped the birds upon him *on his contract.*

This naturally surprised him, but he contented himself for a time with receiving the birds and shipping steadily out of them, day by day, to eastern markets. His shipping room was 20 × 60 feet, and he kept three men at work on them, who kept stacking the surplus receipts behind them at the rear end of the store from the floor to the ceiling. Gradually this surplus crowded them toward the front door, till finally the store was full and they had no room to work in. They then adjourned to a warehouse he had down on the railroad track, and continued operations there!

By that time the banker became alarmed, and tried to get the contractor to let him off, but the contractor, Shylock-like, insisted upon the conditions of his "bond" (contract). The banker then had some hundreds of barrels of grouse on the way from Boston to Liverpool, reshipped to that port on his order by the Boston consignee, because all eastern markets were flooded with grouse and demoralized, while he had yet hundreds of barrels there and on the road to those cities, besides large quantities in his warehouse and store room at home. The banker "threw up his hands" and refused to receive any more birds on the contract. Arbitration was mutually agreed upon between them, and the arbitrators ruled that though the letter of the contract allowed the delivery of an unlimited number of birds at the price named, yet it was evident, from the nature of the case, that it was not intended to cover such extensive operations, and that there was neither justice nor equity in enforcing it farther—in short, they declared the contract "off" and released the banker from that dilemma.

But it was too late to save him. His eastern shipments sold at a big loss, and the eastern markets being glutted for a long time, he was forced to hold a big stock at home while waiting for the markets to clean up and recover prices. While doing this spring opened and his birds thawed out, so that he was forced ultimately to ship by express at high rates. This was slow work, and eventually a large part of these holdings spoiled on his hands. He lost $10,000 in the "round up," and his banking capital went to fill the hole. This happened before the days of cold storage. If such storage had been available at that time, it would have saved this man, and many others, such disastrous losses.

I operated in frozen grouse at Independence the following season. The previous winter had been one of deep snow, forcing the birds to the cornfields for food, and hunger had driven them into the traps in such multitudes that they glutted and demoralized the markets as described. The "catch" had been so large that the crop of trapped birds the following season was of diminished proportions, which led in turn to sharp competition among buyers.

We finally compromised by pooling our interests. In this way we kept down prices on the street, and at night divided the birds and the cost between us. I accumulated a large lot of frozen birds and got from Chicago a lot of new lard tierces to pack them in, my idea being that frozen birds, packed in such an air tight package, with its thick staves, would keep frozen a long time in ordinary winter weather without thawing out. While I was doing this, I became aware that the "close season" had overtaken me—and the birds. During it, the railroads were prohibited from carrying shipments of grouse, under heavy penalties. I got over this difficulty by billing my tierces out as *mess beef*, and it being no part of the railroad company's business to open lard tierces in search of grouse, they got safely out of the state. I considered that I was justified in practicing this deception, since I had bought the birds when it was lawful to do so, and should then have been allowed necessary time to pack and ship them to market.

I sent them to Boston by freight, and returned myself to Wisconsin, directing the consignees to hold the stock on arrival and wait my instructions to sell: for Boston had its periodical glut on, as usual, and stock was being "slaughtered," to the loss of shippers, particularly of those who had shipped by express and had their stock thawed out on the road.

My lard tierces proved to be *good refrigerators*, and justified my confidence in them. In packing, I had wrapped each bird separately in paper, packed them as tightly as possible by hand pressure, and filling the tierce rounding full, then settled the head of the tierce home by screw-press power, carrying the grouse down together in a compact mass. I held them many weeks on the Boston market after their arrival, against the advice of the consignees, who feared that they would spoil on their hands. The market finally recovered and the price went back to $1 per pair, when I wired them to sell. The grouse came out perfectly sound and sold at outside prices; so my improvised refrigerators saved me not only from loss, but made me a profit.

(TO BE CONTINUED.)

THE art of good cider making consists, in the first place, of stopping the fermentation before it proceeds too far, destroying the flavor and quality. Then it should be carefully skimmed and racked off into clean vessels, avoiding carefully all barrels, kegs or tanks which are musty. One further hint is this: That fine cider cannot be fermented or stored where the temperature varies too much. In the first place, the fermentation cannot be conducted properly; if too high a temperature is used or allowed, it will cause too violent an action of the carbonic acid gas, and not only carry off alcohol, but will proceed until it gets beyond control and runs into acetous fermentation. Or, on the other hand, if kept too cold, it will not act as desired, and the cider will remain only partially fermented until the season is past when it should be ready for bottling, causing breakage and loss when warm weather comes. The temperature in storage rooms or cellars should be under control and kept without much variation.

THE "Handy" gate valve made by the Lunkenheimer Brass Manufacturing Co. is a new idea; the valve being opened or closed by means of a lever and not by screw.

[*Written for* ICE AND REFRIGERATION.]

ICE v. MECHANICAL REFRIGERATION.

HOW TO OBTAIN DRY AS WELL AS COLD AIR IN COLD STORAGE HOUSES—A PLAN FOR CONSTRUCTING COLD STORAGE HOUSES COOLED MECHANICALLY.

BY STUART ST. CLAIR.



THE writer has read with interest the several articles on the above subject, and has refrained from making any comments on the subject, until the present stage, being desirous of seeing Mr. Beemer's reply to the arguments in favor of "Mechanical Refrigeration."

The subject has been one of careful thought and much experiment by the writer under both methods; and there is much in what Mr. Beemer says that is bound to attract attention to his very excellent system—a system that would be very difficult to surpass, and which evidently is the result of many years of experiment and doubtless successful practice.

The ordinary methods used in "Mechanical Refrigeration" have not been as satisfactory as one would wish, and there have been good reasons.

First, one of the strong points, made by those installing such plants, has been the little space occupied and the more cleanly and less troublesome manner in which the work is done; but as yet little attention has been given to the quality of the refrigeration. Like the manufacture of ice, anything that was cold would do; but when reduced to a commercial basis this will not work, as the demands in this particular line are becoming of an exacting nature, and not only a certain or specific temperature is demanded, but a perfectly *dry air*. This latter is difficult to obtain, even with Mr. Beemer's excellent system.

The method pursued by the "York Manufacturing Co., Limited," for general storage houses, and after plans of the writer, is, we believe, the only solution to the problem of dry air refrigeration. The appended sketch explains itself, and the arguments in its favor are as follows:

To produce a dry air the entire absence of any condensing or refrigerating surface in the space to be refrigerated is absolutely necessary. The rapid circulation of the air in the room is also of vital importance; and in such circulation no contact of the incoming cold air with the outgoing warm air to make condensation is the result aimed at: hence we place the *refrigerator* at the highest point, and have communicating air shafts from the bottom of the same to the rooms to be cooled. Like shafts ascend from the top of the rooms cooled to top of the refrigerator. The refrigerating coils in the refrigerator are kept at a temperature of zero to 15° below, and a small stream of strong brine is allowed to drip over said coils to a pan underneath, being pumped back to the upper drips as fast as deposited. This brine will have a temperature ranging from zero to 4° below. The action is simple and effective; *all* moisture is either condensed or frozen instantly as it comes in contact with such low temperature, and an absolutely *dry* air descends in the air shafts to the rooms to be cooled.

The temperature of the rooms is regulated by a slide or shutter (not shown in the sketch) on the cold shaft, admitting only such quantity as is desirable, and a temperature as low as zero can be obtained without any difficulty.

I trust that the method herein described may be clear to your readers, and not confused (as we have known it to be) with the ordinary overhead methods on the ice bunker principle, where the temperature was never sufficiently low to properly eliminate the moisture from the circulated air. Your practical readers will readily see the many advantages to be derived from this system. The entire absence of piping in the store rooms is in itself a commendation, as is also the simplicity of the whole arrangement, admitting of the closest regulation, so desirable in the storage of many classes of goods.

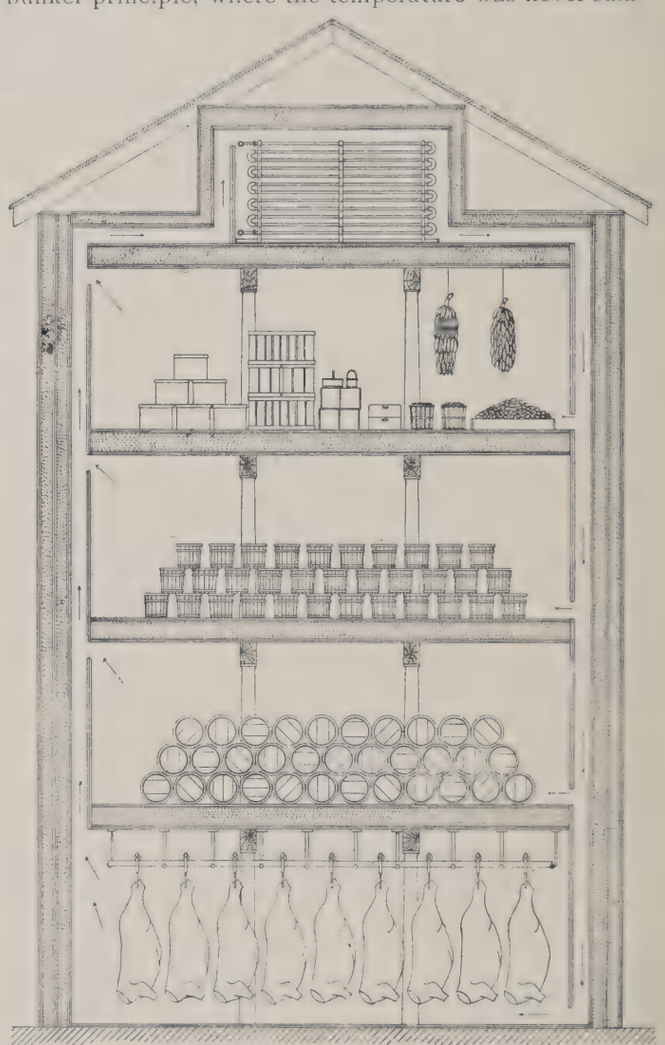


DIAGRAM FOR DRY AIR COLD STORAGE BUILDING.

The writer feels fully assured that the method herein described will be the popular one in general storage, and the pipe and pan system discarded, or used only in breweries or other wet refrigeration.

A SOUTHERN orange grower has placed several boxes of oranges and lemons in a cave where the temperature was about 50° and the air dry, and has succeeded in keeping the former in excellent condition for sixteen months and the latter for a year. As caves are not made to order in Florida, the same result can be had by using the cold storage houses.

[*Written for* ICE AND REFRIGERATION.]

PISCATORIAL POINTS.

HOW SCIENCE OPENS UP NEW FIELDS OF ENTERPRISE—THE FROZEN FISH INDUSTRY AND ITS DEVELOPMENT—HOW FISH ARE PRESERVED IN ICE.



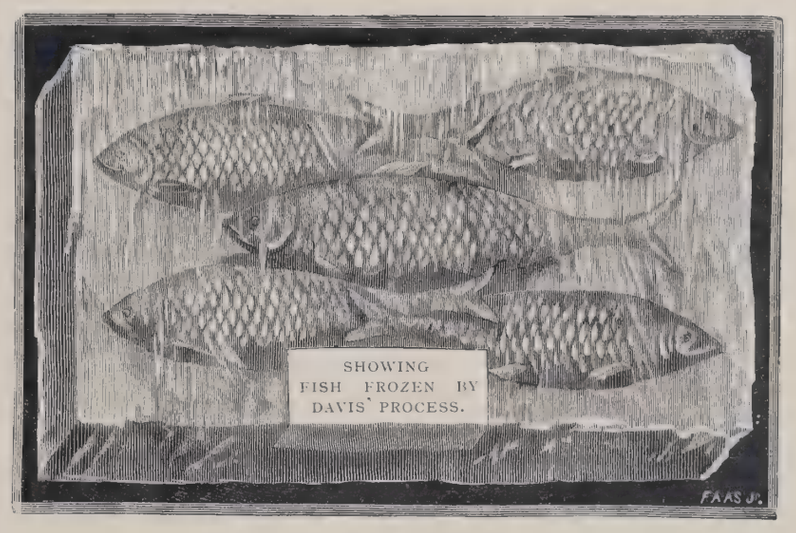
FISH preservation in such condition that they can be transported long distances, even to the "uttermost parts of the earth," and be kept for years, if necessary, as fresh and as palatable as on the day when they were caught, is, of course, as all should now understand, as practicable as the preservation of fruits, vegetables, cereals and animal food, and their transportation over the world. All understand also the magnitude of the salt water fisheries which give employment to thousands of the sturdy seamen of the New England coast; yet it may surprise many of our readers to know that the average total catch of fish on the great lakes, for the past five years, is estimated at 69,742,000 pounds, valued at $1,750,000. Coupling these figures with an estimate of the oyster fisheries, ocean fisheries and of those of the salmon streams of the Pacific coast, the reader may judge of the vastness of the total industry as a factor in the food production of our country.

When navigation closes on the great lakes—to speak of that branch of the industry more particularly—the fishing season closes also: yet in every part of the United States the family table is supplied with whitefish, salmon, trout, bass, pike, etc., from the lakes, that have been preserved by means of ice, and transported from the fishing sloops to all parts of the nation—frozen in winter by artificial cold, as well as in summer.

The frozen fish industry, however, like all modern processes of refrigeration, is of very recent origin. Prior to 1868, says Mr. R. W. Davis, who is really the father of the business, and to whom ICE AND REFRIGERATION is indebted for the information contained in this article, a few salmon were frozen in the East in order to supply the New York and Boston markets with this choice fish when naturally out of season, the process employed being to reduce the temperature of a room, by the use of ice and salt, below the freezing point, and keeping the fish there till frozen. In 1875, however, Mr. Davis invented and patented a process for freezing fish in cakes of ice, the ice and fish to be packed in boxes or barrels for transportation to market, which process was so successful that since that time it has been used by many of the dealers in the United States, and a large part of the supply of fresh water fish for winter consumption is now preserved by this process. The first lake fish frozen in the West was by the Davis freezing pans in 1868. In Detroit, Mich., about sixty tons of whitefish were frozen, and at Toledo, Ohio, about seventy-five tons. It was almost impossible to dispose of this quantity of fish, even at a low price, as the dealers were at first suspicious of artificially frozen stock (as they have ever been of any radical departure from old, familiar methods); but the prejudice eventually gave way, and in consequence the demand for frozen fish has steadily increased from year to year, from a mere handful in 1868 to some 2,000 tons in 1890.

By the process for freezing fish, which Mr. D. W. Davis, of Detroit, invented, the fish are packed in pulverized ice, and frozen solid. The process is based on the assumption that by freezing the fish within the ice the air is excluded from them until wanted for use, and that, therefore, they come out as fresh and plump as when first caught—two desirable characteristics of the fish which, he maintains, are better preserved by this method than by simply freezing the fish solid, as is ordinarily done in cold storage—a process of preservation previously and elsewhere alluded to in ICE AND REFRIGERATION.

In brief, the Davis process is as follows: A galvanized iron pan, thirty-five inches long, twenty-five inches wide and four inches deep, will hold about thirty pounds of pulverized ice and fifty pounds of fish. The fish after being packed in these pans in the pulverized ice, are



SHOWING FISH FROZEN BY DAVIS' PROCESS.

piled in bins with alternate layers of ice and salt, in the right proportions of ice and salt, to produce a temperature of zero. There they remain for ten to twelve hours, after which time the fish and pulverized ice in each pan will have thoroughly congealed into a solid cake—just like a solid block of ice, in fact.

These blocks of fish, incased in their crystal jackets, are then stored away in freezing chambers, where the temperature is always maintained below the freezing point. Here, of course, they will remain in exactly the same fresh condition as when caught or frozen, until they are ready to be sold to the dealer.

SINCE the practical closing of American markets to the Canadian egg, that valuable crop of the Dominion has been going this fall and winter to England, and selling at such good profits that a single consignment recently from Montreal realized a profit of about $5,000. This shipper expects before the close of the season to put from 30,000,000 to 35,000,000 Canadian eggs on the English market, being able to deliver them at Liverpool at 1d. per dozen less for freight than can his French competitor across the channel.

NEW COLD STORAGE PLANTS.

The reorganized Produce Cold Storage Exchange, of Chicago, are proceeding rapidly with the completion of that plant. The new company is officered as follows: Geo. M. Moulton, president; E. G. W. Reitz, vice-president; Adolph Loeb, Geo. C. Prussing, John Agnew, Joy Morton, Frank B. Lawrence and Jas. B. Van Cleave, directors. The buildings will be completed according to the plan projected by the original company.

The ways and means committee will soon send out specifications for the ice machine and cold storage plant desired for the Columbian Exposition. We have endeavored to secure definite information for this issue, but the details of specifications were not ready on going to press. The information will be given later.

ALABAMA.

Gadsden.—J. W. Hancock, general manager of the Rome ice factory, of Rome, Ga., who also represents the Birmingham Brewing Co., has been in the city looking for a site on which to build a cold storage to handle ice and beer.

COLORADO.

Denver.—The Colorado Automatic Refrigerating Co. is increasing its capacity four-fold.

FLORIDA.

St. Lucie—The Indian River Fish and Oyster Co. talk of putting up a new ice making plant. All information can be obtained from J. J. Falvey & Co., Atlanta, Ga.

GEORGIA.

Athens—Samuel Rexinger will put in a 10-ton ice making plant of the Keeling pattern, made by the Van Winkle Gin Machine Co., Atlanta, Ga.

Athens.—Reynolds & Cooper are about to establish cold storage rooms at Athens.

ILLINOIS.

Charleston.—The new ice manufacturing company will have cold storage room of 18,000 to 20,000 cubic feet for commercial storage.

Chicago.—The Auditorium hotel is to have an Ainslie, Cochran & Co. refrigerating machine. The Louisville Pipe Bending Co., of Louisville, Ky., have just finished the coils.

Chicago.—The Chicago Produce Cold Exchange have recently closed contract with the De La Vergne Refrigerating Machine Co., of New York, for two 65-ton machines and complete direct expansion piping for their storage and freezing rooms. The engine room will be made large enough to admit of two additional machines each to have a capacity of 150 tons.

Kearney.—Geo. Keek & Co., of this city, have recently procured a building, which is being turned into a cold storage warehouse. The ice box when completed will hold 3,000 tons of ice.

Sepo (Lewiston, P. O.).—Ed. Maur is putting in ice and a small cold storage plant in which to handle country produce.

INDIANA.

Bristol.—Geo Milburn has filled an ice house to run a cold storage room to carry fruit.

Fort Wayne—Leikauf Bros. are to build a cold storage house.

KANSAS.

Parsons.—The Parsons Cold Storage and Packing Co., of this city, has been chartered, with Thomas Bingham, Joel Tiffany, Conrad Hinkle, C. A. Wilkin and G. A. Nicholetts as directors for the first year. The capital stock of the company is $60,000.

MASSACHUSETTS.

Salem—Capt. Edward B. Trumbull is planning a cold storage building.

MICHIGAN.

Detroit—McDonnell Bros. are contemplating the erection of a cold storage plant.

MINNESOTA.

St. Paul—William McCormick is about to build a cold storage house on Chicago Avenue.

NEBRASKA.

Omaha.—The Western Cold Storage Co., of Omaha, has increased capital stock to $25,000.

OHIO.

Lagrange.—L. W. Richmond will build an extensive cold storage house the coming season.

Toledo.—John Atkinson has just completed a cold storage house for handling eggs.

PENNSYLVANIA.

Philadelphia—The Philadelphia Packing and Provision Co., Philadelphia, Pa., have recently contracted with Joseph Koenigsberg for two 50-tons each Consolidated ice machines.

Reading—The Reading Cold Storage Co. have purchased two 33-ton and one 35 ton De La Vergne machines for their new plant.

TEXAS.

Brenham.—The Brenham Compress, Oil and Manufacturing Co. held a meeting January 30 to consider the erection of a cold storage and ice plant, fifteen tons capacity. Wm. Perry was appointed a committee of one to examine different plants and report to the stockholders.

Houston.—Martin Casey, T. F. West and Z. Cetti, of Fort Worth, will, it is reported, erect a cold storage plant.

VIRGINIA.

Roanoke—The Roanoke Cold Storage Co will add $20,000 to their capital stock.

WEST VIRGINIA.

Wheeling—January 20 the stockholders of the Wheeling Ice and Storage Co. elected a new board of directors and voted to increase capital stock by $25,000, in order to build a cold storage house, a branch of their business hitherto neglected.

WISCONSIN.

Berryville—There is talk of building a vegetable storage warehouse, to cost about $5,000.

Fond du Lac—Galloway & Martin have purchased land on which they will build a cold storage house in which to handle butter, eggs, poultry, etc.

Green Bay—L. D. Dorschel & Bros., of Chilton, are remodeling a building 42×100 feet, for general cold storage purposes, to be cooled with ice.

BREWERY REFRIGERATION.

——Wm. Ritter, Chicopee, Mass., has bought a 5-ton Case refrigerating machine for his brewery.

——The Phenix Brewing Co., Louisville., Ky., has put in a 120-ton Sulzer-Vogt refrigerating machine.

——The Woodside Brewing Co., Woodside, L. I., N. Y., has purchased a 20 ton Case refrigerating machine.

——Daniel Deprez, agent for Aurora beer at Shelbyville, Ind., has purchased a 6-ton Sulzer-Vogt refrigerating machine.

——The Knoxville Brewing Co., Knoxville, Tenn., have purchased a 50-ton refrigerating machine of the Sulzer-Vogt Machine Co.

——H. Luhr, brewer at St. Mary's, Pa., has purchased of the Case Refrigerating Machine Co., a 5-ton refrigerating machine.

——Star Brewery, of Chicago, have ordered from the De La Vergne Refrigerating Machine Co., of New York, a 100-ton refrigerating machine.

——The Jos. Schlitz Brewing Co., Milwaukee, are having their new stock house piped for refrigeration by the De LaVergne Refrigerating Machine Co.

——The 150-ton refrigerating machine of the De La Vergne make, which the Fred Miller Brewing Co., Milwaukee, have erected is now in running order.

——The International Brewing Co., of Buffalo, N. Y., will put in a 65-ton Case refrigerating machine, in addition to the Arctic machine now at work in this brewery.

——The Texas Brewing Co., Ft Worth, Tex., have just contracted with the De La Vergne Refrigerating Machine Co., of New York, for a 100-ton refrigerating machine and 40-ton ice plant.

——The Columbia Brewing Co., St. Louis, Mo., have awarded the contract for the entire refrigerating machinery for their new brewery to the De La Vergne Refrigerating Machine Co., of New York.

——A 100-ton refrigerating machine and 50 ton ice making plant will be erected at Houston, Tex.: the contracts have already been awarded to the De La Vergne Refrigerating Machine Co., of New York.

——Conrad Pfeifer, of Detroit, has ordered an 18-ton refrigerating machine of the type designed by Edward C. Post, of Monroe, Mich., to be built by F. Heutteman & Co., of Detroit, which will be erected in his brewery.

——The John Schuessler Brewing Co. of Buffalo, has closed a contract with the Case Refrigerating Machine Co., for the erection of a 65-ton refrigerating machine at their brewery, to be placed beside a De La Vergne machine now running.

——The following breweries have ordered De la Vergne refrigerating machines since February 1: Eldredge Brewing Co., Portsmouth, N. H., 35-ton; Henry Leix & Sons, Utica, N. Y., 9-ton; American Brewing Co., Providence, R. I., 65-ton.

——Anheuser-Busch Brewing Association, St. Louis, are preparing to put in the enormous 500-ton refrigerating machine built by the De La Vergne Refrigerating Machine Co., of New York; it is expected to have the machine running by May first. They have also ordered from the same company a 75-ton ice making plant.



DURING the month Maurice Duclos, of Paris, expert of the French customs service and the representative of the French government to investigate the pork inspection system of this country, on February 11 visited the great packing houses at the Union Stock Yards, Chicago, and was shown all over the larger plants, and examined thoroughly the operations of the microscopists at work inspecting pork. The specimens for examination are contained in tin boxes, each numbered, the number corresponding to the number of the carcass from which the specimen is taken. There are three samples taken from each carcass, and each sample is examined under the microscope in three places. If trichinæ are found in any place the carcass is condemned. The samples are prepared for the slide by clipping off a small piece with a pair of scissors and putting it in a small compress. Each operator examines about sixty carcasses a day, and as nine examinations of each carcass are made a day's work comprises about 9×60, or 540, examinations. M. Duclos, having finished his work, speaking of what he had seen, said: "I think we'll be fully satisfied. Everything seems to be satisfactory. I am merely gathering the facts to make a report to my government. I am highly pleased, and so are the other gentlemen who have come with me. Plenty of attention is given to the examination of the pork. Nobody should be afraid to eat it. I do not discuss the question of tariff restriction in France. My mission has nothing to do with that. I am here to see the methods of inspection by the United States government. It is purely a scientific mission I am on. There is nothing political or diplomatic about it. I hope to say more when I get through with my inspection." On the following day M. Duclos and his associates, M. Roume, of the French foreign department of the ministry of commerce, and M. Riche, member of the medical academy of France and chief in the office of the secretary of trade, went to Kansas City to examine the work there.

PACKING HOUSE NOTES.

——A small packing house is to be erected at Burlington, Iowa.

——Plaut Bros., of Johnson avenue, Brooklyn, will put in an ice machine.

——The Phœnix Packing Co., Kansas City, is about to enlarge their plant.

——Chicago and Omaha capital will erect a $200,000 packing house at Creston, Iowa.

——Work has begun on an enlargement of the plant of the Armour Packing Co., Kansas City.

——A company with a capital stock of $50,000 will erect a packing house at Charles City, Iowa.

——Schwarzschild & Sulzberger, wholesale butchers of New York, are in the market for an ice machine.

——The new Moran packing house at the St. Joseph, Mo., stock yards will probably be opened April 1.

——The Cudahy Packing Co., Omaha, Neb., will spend $150,000 on new buildings, which have been begun.

——The smoke house at "Kingan's" packing house, Indianapolis, was burned January 22; loss, $2,000; insured.

——L. G. Clark, of Pittsburgh, has gone to Boone, Iowa, to take charge of the new ice machine at the packing house.

——Wm. Geringer, pork and beef packer, of Cincinnati, has purchased a 15-ton Sulzer-Vogt refrigerating machine.

——The Iowa Packing Co. is to be removed from Sabula to Clinton, Iowa. The company's capital has been increased.

——Kingan & Co., Kansas City, will erect a large addition to their pork packing house in order to go into the dressed beef trade.

——Geo. Byers' sheep slaughter house at Kansas City was burned January 22; loss, $1,000; insurance, $800. He slaughtered for shipping trade.

——John Moore, lately with Kingan & Co., with others, are about to organize a new pork packing company to erect a plant at Indianapolis, Ind.

——The B. & M. Packing Co., Denver, will lease the Colorado Packing Co.'s former plant, and the capital stock is to be doubled from $100,000 to $200,000.

——A syndicate has been formed at Indianapolis, Ind., to establish another house for slaughtering cattle and shipping dressed meats on an extensive scale.

——The Atlantic, Iowa, Packing Co. are killing about 500 hogs per day. The company has recently erected new ice houses and put in some 5,000 tons of ice.

——Swift & Co. will enlarge their dressed beef plant at Kansas City, one of the additions being designed as a car shop to build and repair their own refrigerator cars.

——T. W. Trumbull, lately with the Armours, at East Saginaw, Mich., is at the head of a movement to organize the Trumbull Beef Co., to handle dressed beef in that city.

——The Chicago Packing Co., Nebraska City, Neb., will put up about 2,000 tons of ice this winter. The first installment of machinery for the artificial ice plant arrived January 20.

——The four packing houses at South Omaha slaughtered 1,265,219 hogs, 421,958 cattle and 81,279 sheep, and paid out $28,000,000 during the year 1891. They employed 3,400 men.

——J. M. Doud & Co., the Des Moines, Iowa, packers, are putting in an ice machine. The capacity of the house will be doubled during the summer, and total improvement will cost $40,000.

——The directors of the G. H. Hammond Packing Co., held a meeting February 11, at Chicago, to discuss the advisability of enlarging the capacity of their works at Omaha. Action was deferred.

——The Hammond Dressed Beef Co. of Hammond, Ind., has bought the four-story warehouse at Eutaw and Conway streets, Baltimore, from the trustees of the Johns Hopkins University, for $19,000.

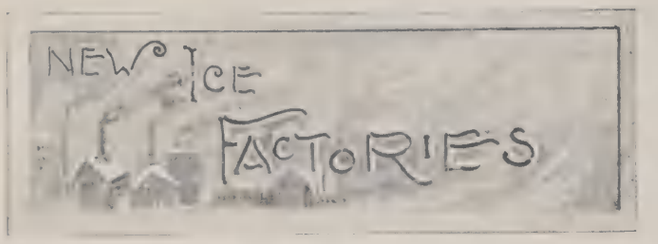
——Nuckols & Tucker, of Leadville and Aspen, Colo., have purchased Grant Bros.' slaughter house in Pueblo. They will erect store buildings and refrigerators and so forth, expending $50,000 on the plant.

——The Ryan Packing Co., Dubuque, Iowa, has leased a large building and put in a gas engine to run the elevator, the intention of the company being to use the new quarters for the storing of pickled meats exclusively.

——The Swift Packing Co., of Omaha, has made arrangements to erect a brick building at Lincoln, Neb., for the purpose of storing and distributing its products in that city. The company began business in Lincoln last September and has since been hauling its meats direct from refrigerator cars in the railroad yards.

——Nelson Morris, the well known Chicago packer, is in San Francisco, inspecting his new packing house plant at Baden, or South San Francisco, as it is called. Three of the buildings are nearly completed, and abattoirs and wharves are in course of construction, while the dredging for canals and various other improvements is under way. "There is nothing of a speculative nature in the project," said Mr. Morris. "It is a legitimate business enterprise, in the hands of practical business men. It is hard to say when we will begin actual operations, but we shall probably be ready for business before many months.

THE Central Traffic Association, Chicago, recently held a meeting to discuss the refrigerator car mileage rates; when it appeared conclusively that the Canadian Pacific had contracts at the present rate of one cent a mile to run for three years yet. It was after full discussion decided to be impracticable for the other lines to attempt a reduction to the former rate of three-fourths of a cent per mile. A resolution was adopted to the effect that present mileage rates on dressed beef and articles taking dressed beef rates be continued until changed by agreement. This probably disposes of the question for three years, and the disposition will no doubt be satisfactory to the refrigerator car companies.



There is nothing special to note this month in the line of construction of ice factories. There is moderate, healthy activity in building, but nothing extraordinary. While some timid investors may be induced to hesitate on account of the size and wide extent of the ice harvest made during January and February, still there is no reason to doubt the continued and increasing success of the ice factory. Ice crops like that made this season are comparatively rare, and can have no permanent, even if they have any temporary, effect on ice factories judiciously located. Our monthly record of events in this line is as follows:

ALABAMA.

Eufaula.—Mr. Echols, of Huntsville, is arranging for the establishment of an ice factory.

Florence.—After nearly twelve months' idleness the machinery of the ice factory will soon be in operation. The trouble was that no water could be obtained on the company's lot. Several pumps are now in operation, furnishing over eighty gallons a minute.

ARKANSAS.

Pine Bluff.—Plans have been accepted for a 30-ton factory to be completed by May 1.

CALIFORNIA.

Fresno.—The Fresno Artificial Ice Co. will erect a 20-ton plant, and have contracted for a Blymyer machine.

Pasadena—Is making an effort to secure the establishment of an ice plant there.

CONNECTICUT.

Asbury Park.—An artificial ice company is being organized at Asbury Park, which will use artesian water exclusively.

DELAWARE.

Dover.—The Dover Artificial Ice Co. will have a 10-ton plant ready to manufacture ice in a few weeks.

DISTRICT OF COLUMBIA.

Washington.—The Hygienic Ice Co. will increase the capacity of that plant from 100 to 160 tons daily. Their water supply is a battery of natural springs.

FLORIDA.

Kissemee.—The Kissemee Ice Co. has started up their factory after numerous trials and failures, the ammonia pump being the cause of the trouble.

St. Petersburg.—The Tampa Bay Ice Co. has been incorporated, with G. W. Codington, president; W. Y. Hildrun, vice-president, and C. R. Switzer, secretary, to operate the Tampa Bay ice factory. This company is also privileged to erect an electric light plant, construct water works, etc.; capital $20,000.

GEORGIA.

Dalton.—The Dalton Ice and Cold Storage Co. will increase the capacity of its plant and add new machinery.

ILLINOIS.

Charleston.—The Charleston Ice Manufacturing Co. has organized by electing the following officers: President, E. J. Blair; secretary, J. M. Hayes; treasurer, James H. McClelland; directors, J. A. Harley, C. A. De Haven, F. Cooper and C. H. Bissell. The company already have the foundation finished for their factory. It will be a 7-ton plant.

INDIANA.

Lafayette.—The Artificial Ice Co. are setting up a third boiler in their plant.

IOWA.

Des Moines.—W. A. Hutchings, of Peoria, Ill., has agreed to erect an ice factory to cost $50,000, provided he can be assured of patronage. He agrees to deliver ice at 35c. per cwt., or 50c. per week, daily deliveries of fifteen pounds. The plant will be ready by June 1 if erected.

KENTUCKY.

Mayfield.—The Mayfield Water and Light Co. will erect an ice plant in connection with their water works here. R. M. Beadles is secretary of the company.

LOUISIANA.

Algiers.—The foundations and walls of the plant of the Algiers Ice Manufacturing Co. are finished. The company expect to make ice by May 1.

Donaldsonville.—The Donaldsonville Ice Co. have made second call for 25 per cent of capital stock for construction.

Shreveport.—The Consolidated Ice Co. will add to their plant a 50-ton De La Vergne machine.

MARYLAND.

Baltimore.—August Fenneman, J. H. Shabb, R. B. Tippett and others have incorporated the Independent Ice and Coal Co. with a capital stock of $20,000. Their plant is already equipped with machinery.

Baltimore.—The Maryland Ice Co. on Fell's Point are arranging to put in a plant to use Lima oil in place of coal as fuel for their boilers. The daily consumption will be 6,000 gallons. Tanks are being built to hold 40,000 gallons.

Cumberland.—The Cumberland Ice Manufacturing Co. have purchased the Hobel brewery property for their plant. This company will at once tear down the old buildings and commence erecting a new one as soon as the plans arrive from the Frick Co., of Waynesboro, Pa. Artesian wells will be bored to obtain a supply of pure water. Mr. David Walker, who was elected manager of the company, has said the company would have ice in the market by the first of May.

MISSOURI.

Moberly.—Work has begun on the erection of an ice factory, by Fred Devero and C. Crawford. An artesian well will be sunk for water. The plant will cost $15,000.

St. Joseph.—The St. Joseph Artesian Ice Plant will be doubled in capacity the coming season. Manager Steinacker has closed a contract for a sufficient quantity of machinery which will arrive in a short time. The power now employed in the plant is sufficient for a doubled capacity, and the building will probably require no immediate extension.

NEW JERSEY.

Elizabeth.—The Elizabeth Ice Co. has purchased a 30-ton ice making machine from the Blymyer Ice Machine Co.

NORTH CAROLINA.

Durham.—Louis Arnold, of Louisville, Ky., will, as lately stated, erect an ice factory in Durham.

OHIO.

Youngstown.—The Crystal Ice Co. has received plans for the plant to be erected from the Arctic Ice Machine Manufacturing Co., of Cleveland. The company will now advertise for bids.

Youngstown.—The Youngstown Ice Co. has decided to increase the capital stock of the company from $12,500 to $25,000. They also decided to purchase an ice machine and manufacture ice as well as harvest it in the old way.

OKLAHOMA.

Guthrie.—The new building for the ice plant is over twice as large as the old one, and the factory will have a capacity of twenty-five tons per day.

PENNSYLVANIA.

Bloomsburg.—Efforts are being made to organize a company for the manufacture of ice. Twenty-five thousand dollars are wanted to begin with.

Philadelphia.—The Glenwillow Ice Manufacturing Co., of Philadelphia, has been incorporated; capital, $200,000; president, Peter P. Liebert. A 60-ton De La Vergne ice machine has been bought.

Philadelphia.—An ice factory, 176×80 feet, will be erected at Glenwillow avenue and the Philadelphia & Reading Railroad by M. Schmid.

York.—The York Ice and Refrigerating Co. is enlarging its plant by taking out the former 10-ton simple machine and substituting a 25-ton compound machine manufactured by the York Manufacturing Co.

SOUTH CAROLINA.

Blackville.—The Crystal Ice Co., capital $10,000, has been incorporated by P. W. Farrell, C. H. Mathis and associates to establish an ice factory and steam laundry.

TENNESSEE.

Chattanooga.—Brown & Rettig were the former owners of the Big Springs Ice Co., and sold out that plant to a company which later quit running. The plant has since reverted to Brown & Rettig, who will dismantle and remove it to a new site, on the C., R. & C. R. R., such portions of the machinery as can be used. A contract has been let for a 50-ton ice machine. The company still owns the Big Springs and will lay a main from the springs to the new works and pump the water from there. The company will not be in the ice pool.

TEXAS.

Brenham.—Albert Smith, of New York, is investigating the town with a view to establishing an electric light and ice making plant.

Hillsboro.—Work on the ice factory is being pushed rapidly, and the owners are contemplating the addition of an electric light plant to their property.

VIRGINIA.

Clifton Forge.—F. M. Jones is organizing a stock company for the establishment of a 10-ton ice factory.

WASHINGTON.

Tumwater.—The Tumwater Ice Co. began making ice February 1. The owners are John Pulles, Henry Fingers and Andrew Hinrick, who have put $12,000 into the plant which has been so arranged that its capacity may be increased with but little difficulty. At present it is capable of turning out ten tons a day, but the intention is to increase it to sixteen tons.

WEST VIRGINIA.

Martinsburg.—An ice factory will be established.

MINOR LEGAL MATTERS.

——Charles Eichner, of Wood county, Ohio, is suing the Michigan Lake Ice Co., of Toledo, for $1,500 damages for personal injuries alleged to have been sustained by one of the company's wagons colliding with his buggy on Cherry street bridge in January. Eichner says he had his knee cap broken in the collision.

——On February 12, Judge Collins, Chicago, authorized the receiver of the People's Artificial Ice Co. to sell the plant. It was represented that claims amounting to $14,000 had been proved up against the company; that the business has been at a standstill for six months, and that the property was rapidly deteriorating in value.

——A telegram from Holyoke, Mass., February 11, says: "The Holyoke and South Hadley Falls Ice Co. have decided to bring a suit for the purpose of finding out whether the Water Power Co. of Holyoke owns half of the Connecticut river on which Holyoke fronts. The Water Power Co. gave the ice company the right to cut ice on the river. Fishermen have been cutting holes in the ice for fishing, and refused to stop when told to do so by the ice company officials. The ice company now proposes to prosecute one of the fishermen in order to make a test case. The fishermen hold that the Connecticut river is too large a body of water for any concern to monopolize. If the case is brought to trial it will settle whether or not the Holyoke Water Power Co. controls certain privileges which they now claim."

——An interesting and important question in patent law came up before Judge Blodgett in the United States court Chicago, February 1, in the suit of the *De La Vergne Refrigerator Co.* v. *John Featherstone*. The suit was to enjoin the alleged infringement of a patent for an ice machine. The inventor of the machine was James Boyle. Boyle filed the application for a patent November 24, 1875, but he died three days later. March 21, 1876, the patent for the ice machine was issued in the name of Boyle. It is contended that no patent was ever legally issued, as in no way possible could a patent be issued to a dead man, and the issuance of the patent to Boyle was the same as though the patent had been issued in blank, in which event it would be void. For the complainant it is urged that the patent was legal, and although issued to Boyle, his administrators or heirs were in no wise barred from the legal ownership. Judge Blodgett took the case under advisement. It is said many patents have been issued in the name of persons who died before the patents were issued, and therefore the decision in this case will have an important bearing on the validity of many such cases.

——A remarkable suit has recently been tried (judgment under advisement) at Memphis, wherein Mrs. Charlotte Waite brought action against J. N. O'Neil & Co., lately in the ice trade there. In 1882 they leased of complainant a tract of land on the river front for seven years; but in 1886 the freshet carried away their ice house and a strip 240×150 feet of the land leased. They then leased ground of other parties, and stopped paying rent to Mrs. Waite. She now sues for $3,225 rent and damage of $20,000 caused by the river to her land. The lease was drawn in the usual form, providing for the return of the property "in like good order and condition" at the expiration of the lease, and plaintiff says the lease contained no saving clause exempting the lessees in case of the bank's caving. Engineer Leach, in charge of the government works, was introduced to prove that the bank could have been protected by the timely sinking of stone and willow mattresses, such as the government has laid hereabout in the last few years. One incident of the trial is good enough to repeat, one of the attorneys in the case being reminded of a speech made by the distinguished Mississippian, S.S. Prentice before the river convention held at Vicksburg in 1844: "Gentlemen of the convention," Prentice said, "I have listened with great interest to all that has been said and all the suggestions made. For my part, I know little about the river. I have studied astronomy and the laws of nature. I believe that when God made the universe He created immutable laws for its guidance, with one exception. When He created the Mississippi River He just flung it down and said: 'Let her rip!'"

——In answer to many inquiries as to where charcoal for filtering purposes can be obtained, we refer to the advertisement of T. B. Wright & Co. in this issue.

THE FIRE RECORD.

——Three ice houses at Akron, Ohio, owned by the Klages Ice Co., were burned January 29; loss, $4,000.

——The Maine Ice Co.'s houses at Booth Bay Harbor, Me., were burned January 23; cause, unknown; partial insurance.

——Dearborn & Mansfield's ice house, Worcester, Mass., was burned February 3; loss, $3,000; insured; cause, incendiary.

——Mansfield & Dearborn's ice house at Northville, Mass., was burned February 13; loss, $3,000; insured; cause, incendiary.

——The Tennessee Packing Co.'s plant near Birmingham, Ala., was burned February 6; loss, $40,000; insured; loss on ice machine, $9,000.

——E. L. Bishop's two ice houses north of Elgin, Ill., were burned February 8; cause, unknown; loss, $10,500; insurance, $7,500; may be rebuilt.

——Two large ice barges were burned at DePue, Ill., January 21; loss, $3,000; no insurance; cause, an attempt to thaw out a frozen pump with a hot iron.

——W. Brown & Co.'s slaughter house and ice houses, and John Kelting's fish packing house and ice house, at Toledo, Ohio, were burned February 6; loss, $23,000; insurance, $7,300.

——The plant of the Transparent Ice Works, in Richmond, Va., owned by Herman Schmidt, was partially destroyed by fire February 14; loss, $11,000; insurance, $6,000; stock on hand uninjured; factory will be rebuilt.

——The building and plant of the Danville Ice Co. were destroyed by fire January 25. The factory was valued at $75,000. The building is a total loss, and machinery useless; insured; cause, incendiary; will be rebuilt. This is the second time the factory has been burned.

——The new building of the New Jersey and New York Abattoir Co., Forty-third to Forty-fourth streets, on First avenue, New York city, will be insulated throughout with the P. & B. insulating paper, manufactured by the Standard Paint Co.

Along in October last a stranger dropped into Indianapolis with a magnificent scheme buzzing around in his cranium like a presidential bee in many big and some little men's heads at this particular season. Renting a piece of ground, he erected a high wooden structure on which he said he intended to mount a pump, so constructed that as the water came from the nozzle it would spray. With this he expected when it became cold weather, to make ice enough to supply the market of Indianapolis, or, as he expressed it, "make a mountain of ice." He waited patiently for cold weather to carry out his experiment until January 2, and it came not. Then he became disgusted with the cussedness of nature, tore down his plant and departed for a place where there is cold weather as a regular diet. Just as he had finally shaken the dust of the Hoosier capital from his tired heels—see the perversity of Dame Nature!—the mercury began to drop, and two days later stood at zero! But the "mountain of ice" never came, and the dealers of the town—who, says the local Solon, were "really worrying"—were saved!

A newspaper published in an interior New York town says: "A rather singular fact in connection with ice harvesting is the inferiority of a season's second crop. Old ice men in this vicinity know by experience that while a second crop of ice may develop a satisfactory thickness and may preserve for the eye all those appearances of cleanliness, clearness and solidity that conspire to the composition of perfect ice, it is a failure for practical purposes. Its brittleness is noticeable during the harvesting process, and after being marketed it becomes slushy and unclean and fails by several hours of lasting as long as first crop ice. Local ice men cannot explain this phenomenon, but there can be no mistake as to the fact." This is interesting, certainly. Won't some wise man please stand up and offer an explanation of the curious phenomenon?



The harvest for this season is now practically over. As a whole, it has been one of the largest put in for a number of years. The cold wave, while severe nowhere except for a few days in January, starting from the west and northwest, swept slowly over the entire country from California to Maine and as far south as the Gulf, an ice-making temperature having been felt even in the middle of some of the South Atlantic and Gulf states and Texas. In all the states where ice may be expected annually, but some of which have not made a crop for from two to four years, there was good freezing weather either in January or February, or both months, to make a crop, with ample time to gather the harvest. Taught by experience the danger also of delaying the cut after marketable ice had been made, the trade and other consumers were fully prepared, with houses in repair and tools in readiness, to gather and house the ice immediately a practicable thickness had been attained; and in consequence the harvest, while the largest for some years, was also probably the most expeditious ever made. There are, of course, certain localities where the cut has not been as great as usual, for the reason that their importance as sources of supply has been temporarily belittled by the fact that local demand has been anticipated by the cut nearer home. The railroads, therefore, will haul less ice than usual, in all probability, or, at least, for shorter distances; and the few inland lake fields, for several years the source of supply for the large cities of the West, have been left practically untouched.

In Indiana the crop has been uniformly heavy, Indianapolis having filled every store house in sight, both for local consumption and the shipping trade usually handled. The brewers and packers have their houses crowded full to the limit, the season having been all of three weeks long.

In Wisconsin every lake and river has furnished a crop, and the only houses not filled are those which have in previous years held supplies for Chicago and lake cities. A number of these have not been filled, the Chicago Knickerbockers, for example, having made no cut at all at Oconomowoc, where usually they house several thousand tons, besides shipping during the cutting season. From Madison a good deal of ice has been shipped south for storage along the Illinois Central road for railroad use. At Pewaukee Armour & Co., Chicago, cut about 120,000 tons for refrigerator car supplies. The Wisconsin Lakes Co., at Milwaukee, cut here also for domestic use and on the river at Milwaukee for refrigerator ice, in all about 120,000 tons.——The crop in Michigan is well in hand, and ample for all local demand. Grand Rapids, as a sample, cutting 35,000 tons, a total largely in excess of last year's cut.—In Minnesota the cut has been heavy, but from St. Paul it is reported that while the houses are full to the roof, the quality of the cut is not up to the average, containing more dirt than usual. At Duluth no ice had been cut for domestic purposes up to February 15, though refrigerating establishments had long since been filled up. Dealers had relied too much on getting lake ice, instead of cutting in the interior for domestic consumption.

The Chicago supply this season has all been secured near home—Wolf Lake, Kankakee, Waldron, Momence, Oswego, etc., which for two or three years past have furnished only light cuts. The ice is of first-class quality and from twelve to sixteen inches in thickness. In other parts of the state, even down in "Egypt," the cut has been large. La Salle and Peru have again, after a lapse of several years, made ice for shipment in barges to the South. All the large and small cities, towns and villages have ample supplies. In some places on still water a second crop has been cut, a number of dealers who had storage room having cut a supply for two years of local demand.——Iowa towns and nearly all of northern Missouri, Kansas and Nebraska are similarly supplied. At Burlington, Iowa, the cut was 7,500 for local use only. At Keokuk 40,000 tons were made, part of which goes to St. Louis. At St. Joseph, Mo., every house is full, whether for dealer, packer, brewer or produce dealer, while the same is true of Kansas City.

In Colorado, Utah, Nevada and the Pacific coast the same story is told, all the mountain lakes and streams having "behaved beautifully," ice less than twelve inches on the regular fields of that territory having been rare, while last season it was only about three inches thick in many parts of Washington, notably at Spokane, where this year the cut is the finest ever harvested.

Ohio has been well supplied, though the cut in the southern part of the state is comparatively thin, and in the northern part there was some snow. The royalties paid the Miami & Erie canal will reach $30,000, which will indicate the size and wide distribution of the harvest. At Sandusky over 70,000 tons have been harvested. At Akron, which has been supplied for two years from Michigan, a two years' supply has been housed. The southern part of the state got plenty of clear, solid ice, but only five and a half to eight inches thick. The Cincinnati Ice Co. put up 35,000 tons, the cakes being cleaned of snow by the corrugating machine so familiar in the east.

The harvesters at Erie, Pa., have had an exceptionally busy season, every local house having been filled and thousands of tons cut for shipment by rail to the interior towns and for railroad uses and car icing, as well as meat coolers of the Western packing houses in western Pennsylvania. Chautauqua lake has supplied the Pennsylvania lines, while at Meadville the Conneaut Lake Co. have stored 50,000 tons. At Reading the cut was of 9-inch ice, the Angelica Co. putting away 100,000 tons and several other companies from 40,000 tons upward. Philadelphia will have to depend as usual on the Kennebec or other outside points for her supply. Up to the 15th of February little ice had been cut in the immediate vicinity of the city for city consumption. The Schuylkill had frozen over twice, but at neither

freezing was the ice thick enough to cut, nor did it last long enough for harvesting, even had it been fit to use. ——In New Jersey the harvest has been generally poor, though some few favored localities, such as Greenwood and other lakes near Newark, made a splendid harvest.

In New York state the harvest began during the last ten days of January and was abundant, the cut being also of good quality, especially on the numerous minor lakes and water storage reservoirs and canals. At certain points, Rochester as an example, a second crop was cut of even better quality than the first crop. The Hudson river ponds likewise have furnished a full crop. In Rockland county cutting began January 23 and practically ended February 13, so far as the large companies are concerned. The ice was from seven to ten inches thick. At Rockland lake, where the Knickerbockers of New York get their best ice, the company put up over 150,000 tons, averaging nine inches thick; and other companies have done equally well. The crop on the river itself has not been altogether satisfactory, and the river houses have been only partly filled. The quality of the ice, especially that made between Albany and the lower river fields (say at Catskill) is not all up to standard. After the ice had formed on the river there came a rain and freshet great enough to start the ice moving, after which came another freeze. The ice consequently was rough and in places was badly overflowed with muddy water. Then, again, some cutters cultivated the crop by removing the snow and flooding in order to increase the thickness. From Kingston to Poughkeepsie the harvest began about the 1st ult., with ice of good quality except that it was only from six to nine inches thick. Taking the state as a whole, and including the upper Hudson and Saratoga lake cuts, the crop has been a large one, and with the single exception of that portion of Hudson river affected by ice jams during the short freshet, the quality has been first-class. An arbitrary increase of 60 cents a ton (to $2.25) in freight rates from Saratoga lake will materially reduce the profit in that particular cut, however.

On February 24, the New York *Tribune* sums up the situation as follows: "The last few days of mild weather have practically ended the season for harvestin ice on the Hudson and the lakes from which New York city gets its ice supply, and unless a severe and protracted cold wave comes over this part of the country in a short time no more ice will be harvested. The ice harvest this winter has not been a full one, but enough has been gathered to insure plenty of ice for the city and the usual shipping trade. The yield on Rockland lake has been a good one, the ice being of the most desirable thickness and of the finest quality ever seen on that favored lake. The houses have been filled to their capacity, so that about 300,000 tons have been secured from this tenderloin cut of New York's ice supply. A full crop on Lake Meaghah, or Sweet Water lake, also has been secured, which makes about 80,000 tons from that source. On the Hudson river, however, not more than three-quarters of the crop that was necessary to fill the houses has been secured. The ice during the early part of February was of desirable thickness and excellent quality, and the supply now secured is of this ice, but during the last week the ice became soft and none of it was cut. Although enough ice has been harvested to insure cheap ice of the best quality for New York next summer, yet there will be little, if any, surplus to carry over for the next year, and if the winter of 1892–93 does not give a plentiful ice harvest New York may experience another ice famine such as it went through in the summer of 1890."

In the New England states, outside of Maine, the crop came a month to six weeks late, during which delay the dealers suffered all the anxiety of hope deferred and uncertainty; yet when the crop did come, about the 1st ult, it was fine and remained long enough for a full harvest. All the houses have been filled and many new houses have been added to those in use last season. Those who cut at the first opportunity got thin ice, but ten inches was the average of the late cut in New England. In Vermont, ice as heavy as twenty inches was housed, but the quality in places was not up to standard, the ice being dirty and muddy on account of rains, thawing, etc. In New Hampshire the cut was highly satisfactory, being thick, solid and clean. The cut in the ponds and reservoirs for Boston's supply began about the 8th to the 10 ult., rains having somewhat delayed the harvest; yet the harvest has been abundant. The state generally will be able to supply the home demand.

The ice firms on the Kennebec and Penobscot rivers have had more than their usual "ups and downs," paroxysms of joy and grief, and periods of exaltation and depression. Ice began forming early in January, and the outlook, with no ice on the Hudson, was extremely comforting: for Maine has kept a sharp eye on the Hudson, and ice stock was "gilt edge." Then there came a thaw, the ice broke up and moving peacefully out to sea disappeared, along with the "ice man's" peace of mind. After several days of anxious waiting, ice again began to form, and when all looked promising again the Penobscot men were horrified to find that the up-river saw mill men were dumping their waste into the river and filling the water with shavings. As the offense is punishable by fine and imprisonment, the nuisance was soon stopped, however. Still the ice formed slowly, and frequent snow storms (one of twelve inches on the level) after the ice became thick enough to bear weight, necessitated frequent cleaning, all of which, with soft weather, retarded the cut until well into February. On the Kennebec cutting started in a small way during the first week of the month, but it was not seriously begun until about the 12th, when ice cleared of snow nine to twelve inches thick, was ready for the cutting crew. On the Penobscot the cut began about the same time, but generally two to three days earlier, and was interrupted by a rain after the 15th. On both rivers the cut was of excellent quality, fully up to the standard, and from fourteen to sixteen inches thick. After the rain ceased another moderate freeze came, and thereafter the ice went into the houses and stacks at a rapid rate for several days, and up to the 20th the prospect for a full harvest on both fields was excellent. At Belfast on the 11th, a three-mast schooner loaded with fourteen-inch ice for Beaufort, S. C., and on the 18th, three three-masters, cleared with ice for Baltimore and southern ports, and three others were waiting for similar cargoes. The

Knickerbockers, of Philadelphia, about the same time began shipping by schooner from North Booth Bay. About the 20th, however, mild weather came again, interrupting the harvest, and ruining the quality of the ice. The lower end of the Penobscot field of the Arctic company, comprising some twenty-five acres, tipped up and began to submerge, and in spite of heroic efforts to save the ice, the upper side of the field kept on sinking, and in a few hours was five or six feet under water, so that work had to be abandoned. A similar trouble occurred at the Union ice company's fields about the same time, and though the ice did not sink so far, it was thought best to stop work on the down-river field for a day or two and wait for more cold weather, which up to the 23d had not come. On the 23d a Bangor telegram says: "The ice crop of the two great ice producing rivers of Maine, the Penobscot and the Kennebec, good in ordinary years for 1,500,000 tons, can now be set down as a three-quarters failure. Monday and Tuesday the sun beat upon the fields which had upon them no snow, striking all the ice and suspending operations. There cannot be found upon tide water in either river ice over ten inches thick, and this is honeycombed to such an extent as will make necessary some days of freezing weather to put it in merchantable condition. Only about 60,000 tons of ice have been put up on the Penobscot, all of which will not fill contracts. Baltimore, Philadelphia, Washington and Norfolk are depending largely upon the Kennebec, as dealers in those cities have permanent houses along the banks. It has never been considered safe to put up March ice, and unless the next three weeks should be unprecedentedly cold, there will not be a pound of good ice for market. Such as has been housed averages fourteen inches."

NATURAL ICE NOTES.

——Dealers at Decatur, Ill., put up 20,000 tons.

——D. W. Blake has a new house at Cornell, Ill.

——Mr. Bakey has a new house at Columbus City, Ind.

——R. H. Sargent has a new house at Merrimac, Mass.

——Frank Potts has built an ice house at Decatur, Mich.

——The Moline Ice Co. have built a new house at Moline, Ill.

——Mr. Bodeker has put up a new house at Murphysboro, Ill.

——Yost Bros. have gone into the ice business at Lockport, Ill.

——Wm. T. Robinson has built a new house at Bethany, Conn.

——C. G. Wolfe & Co. is a new ice company at Fort Dodge, Iowa.

——Sharp & Co. have built a new house at West Duluth, Minn.

——Robert Machett has built a small house at West Mystic, R. I.

——McCabe & Snyder have built a new house at Oconomowoc, Wis.

——Maurice Prindeville has erected a new house at Dotyville, Wis.

——Jos Horner has filled a new 50,000-ton house at Clermont, Ky.

——Featherston & Keith have built a new house at San Marcial, N. M.

——The Northern Lakes Ice Co., of Lafayette, Ind., put up 25,000 tons.

——Capt. Nat. Doughty has filled a new house at Dias Creek, N. J.

E. D. Sanford has filled a new house at Hampden Plains, Conn.

——A 400-ton ice house has been built at Elitch's garden, Denver, Colo.

——Mr. Christiansen has put up a new house at Benton Harbor, Mich.

——W. E. Dailey has a new house at Quincy Reservoir, Weymouth, Mass.

——Hod Cook and others have erected and filled a new house at Pekin, Ill.

——The ice houses at Louisville, Ky., have all been filled; many with six-inch ice.

——T. S. Hittenger has built a new house at Brookline, Mass., to hold 40,000 tons.

——The Youngstown, (Ohio) Ice Co. has erected a new 2,000-ton house at Warren.

——The Connecticut river was closed with ice January 28, for the first time this season.

——The Standard Ice Co., Bay City, Mich., have built a large addition to their house.

——Henry McBride & Co. have built a house at Lake Geneva, Wis., to hold 50,000 tons.

——Lloyd Nash, has built an annex to his house at Westport, Conn. He housed 4,000 tons.

——The cut at Oshkosh, Wis., from Lake Winnebago was about 40,000 tons of fifteen-inch ice.

——The ice houses at Webster, R. I., burned in December, will be rebuilt with increased capacity.

——R. L. Blaisdell, of Agawam, Mass., has filled one house and is now building another to hold 500 tons.

——The Harvey's Lake Ice Co., R. M. Colburn, superintendent, has built a house at Pittston, Pa.

——Wm. Frizzell & Sons have erected a delivery storage house of 200 tons, at Colorado Springs, Colo.

——The Northern Lake Ice Co., of Camden, N. J., has been incorporated; capital, $400,000; paid in, $2,000.

——Laurel, Del., harvested 4-inch ice in January, the first time the local houses have been filled in four years.

——The Booth Packing Co. have put up 5,000 tons of ice at Bayfield, Wis., for use in handling fish at that point.

——Huse & Loomis cut 5,000 tons at La Salle, Ill., loaded on barges, to be floated South at the opening of navigation.

——The United Ice Co., Trenton, N. J., have stored 15,000 tons at Iliff lake, and built this month an additional house.

——A full supply of ice of excellent quality is being harvested in the Shenandoah valley and southwestern Virginia.

——The nine houses of Kingan & Co., packers at Indianapolis, Ind., have been filled at Broad Ripple, Ind. They hold 23,000 tons.

——The Consumers' Ice Co., of Albany, N. Y., has been incorporated; capital, $10,000; D. J. Hartnett and others, directors.

——The ice crop at Green Bay, Wis., will not be very extensive this season. Only local dealers and consumers have filled their ice houses.

——The National Ice Co., of Tacoma, Wash., has been incorporated by Fred. A. Morgan and others; capital, $50,000; business, to make, cut and sell ice.

——C. S. Packard, of Waltham, Mass., has, during the past year, removed his ice houses from Crescent Park to "Night Cap Corner," Newton, where he has storage for 10,000 tons.

——The cut on the Mississippi at Lyons, Iowa, was about 13,000, a decline of 50 per cent, owing to abundance of ice at inland points. At Fulton, the cut was only 17,000 tons.

——Ottawa, Kan., and a great many other minor towns of that state, which for the last three years have gone to Nebraska and Iowa for ice, have this year housed abundant supplies for local use.

——Thomas Summerville, Bunker Hill, Ill., has just completed two new houses; capacity, 1,500 tons, and has harvested 1,000 tons 6-inch to 10-inch ice from his ponds, which cover about two and one-half acres.

——A good deal of 4-inch and 5-inch ice was put up in Maryland towns in January; but the major part was anything but clear, and flinty, and was largely composed of snow, and very indifferent in quality. It may supply in a way the demand of the villages where harvested.

CHARLES O. GAGE, of Addison, Gage & Co., ice dealers, operating as the Boston Ice Co., died at Arlington, Mass., January 25. He was the senior member of the above-named firm, one of the oldest firms in this country engaged in the ice business. He was for a great many years engaged in the ice business in Savannah, Ga., being associated with Mr. Alfred Haywood, under the firm name of Haywood, Gage & Co. He was also interested in the same business in Brunswick, Charleston, S. C., Mobile, Ala., New Orleans, La., and Galveston, Tex. At his death he was the largest stockholder in the Central Ice Co., which controls the Gorrie Ice Co., of Savannah. He leaves a son and three daughters.

ABOUT PRICES.

THE OUTLOOK FOR THE COMING SEASON—THE DANGER—LOCAL ORGANIZATIONS DESIRABLE—REFORM IN RETAIL DELIVERY METHODS—THE TICKET SYSTEM.

It is a little early, perhaps, to begin talking of retail prices for the coming season, but there are some suggestions that may with propriety be made at this time, based on the meager hints already thrown out as to the policy to be pursued as soon as the warm months arrive and the retail season begins.

First, of all—Don't get excited. This is trite advice, no doubt, but the magnitude and universality of the ice crop harvested in January and February in all parts of the country will certainly give a character to the business this season it has not had for several years. All the conditions of the trade are, in the language of the "wheat pit," naturally "bearish." With very few exceptions every center of consumption has gathered a full supply, every house is full, and as a consequence the "scramble" will be to sell; and if it is true, as many dealers complain, that there was but little money in ice during the past two or three years, when the crop was short, what is likely to be the result this year, when the crop is large? The conditions, in a word, are ripe for a general demoralization of prices unless an effort is made to counteract this inevitable tendency.

The necessity for local organization is, then, more apparent than ever, through which dealers may arrive at a mutual understanding and agreement as to prices. We are aware, of course, that such organizations are not popular with consumers and the local press; but the ice dealer, as every other business man, is entitled to his fair profit on capital invested and time devoted to superintendence, and there can be no legitimate objection to local organizations looking to better service in delivering ice; the prevention as much as possible of ruinous competition; and perhaps a reduction of expenses by a division of territory, thus avoiding the necessity of going over the same ground by the different dealers. It is not necessary nor advisable to put prices beyond the limit of a legitimate profit; but it is proper and right for the trade to insist that a profit shall be made. This local organizations can effect, and on lines legally and morally justifiable, as much so as in any other of the numerous businesses now guarded by such precautions.

A good deal of money can be made, and much satisfaction derived, also, from a reform in delivery methods, which, in the main, in the North, at least, are about as bad as they well can be. In the first place, payments are collected very irregularly—in the cities once a month, as a rule; in the minor cities, towns and villages, at the end of the season. It is difficult to see why ice should not be a cash article as much as milk or the water tax, both payable in advance, or gas, guaranteed by a meter deposit returnable on presentation of "final bill" receipted. The metropolitan system of monthly payments on the basis of a duplicate record of actual deliveries, one of which is in the possession of the consumer, is the least objectionable, perhaps. The contract system—so much money for so much ice in a certain given number of deliveries per month, or per week "by the season"—is another form of the evil, satisfactory to neither consumer nor dealer, even when based on the "ton ticket," with numerals for canceling the amounts of ice delivered, in lots of fifteen, twenty or twenty-five pounds, or their multiples, which is chiefly objectionable for the reason that it makes the ice dealer his patrons' banker for three to five months without the privilege of "calling" his loans, thereby forcing him to an unreasonable investment in working capital. But the crowning abomination is the "monthly system," without records or checks of any sort, which prevails to a large extent in all parts of the country, entailing endless disputes over irregular deliveries, short weights, charges for extra quantities, concessions to honest but generally mistaken customers, rows with chronic "kickers," disputes with drivers, etc., *ad lib.*—enough to drive a level-headed man into hades!

The plan recently adopted in Denver, Colo., by the Colorado Automatic Refrigerating Co., following the best methods in use in the South, is one which, we think, merits the attention of dealers generally. It combines two features which go far to eliminate trouble with consumers, to wit: Advance monthly payments and definiteness as to amounts actually delivered. The plan proposed is to sell tickets of ten pounds, fifteen pounds, twenty pounds, twenty-five pounds, thirty pounds, thirty-five pounds, forty pounds, forty-five pounds and fifty pounds, at prices based on the old scale of monthly rates. For example, for ten pounds of ice for one month, $2 has been paid. Now, thirty tickets for ten pounds each will be sold for the same—$2. For fifteen pounds of ice daily, $2.25 per month has been paid. Under the new system, thirty fifteen-pound tickets will be given for the $2.25; and so on. These tickets will be for sale at the company's office, by their drivers, and also at drug stores all over the city, where they can be bought in quantities to suit; and where also blank postal cards ordering ice delivered may be obtained free by the public. The scale of prices by this system will be as follows, for family use:

Amount.	Thirty Tickets.	Single Deliveries. Cash.
10 pounds	$2.00	$0.10
15 pounds	2.25	.15
20 pounds	3.00	.20
25 pounds	3.75	.25
30 pounds	4.50	.25
35 pounds	5.25	.30
40 pounds	6.00	.35
45 pounds	6.75	.40
50 pounds	7.50	.40

At the opening of the season the company will place a small tin box at the disposal of each customer, in which the ticket will be placed calling for the amount of ice needed. The driver will go to this box and see how much ice the ticket calls for, which ticket he takes, delivering the amount indicated. If there is no ticket in the box, then he assumes no ice is wanted and will leave none. No payment can be made nor charges collected, and the consumer therefore pays for what ice he needs, and no more. A system of rewards has also been devised to be paid to the drivers against whom the fewest complaints are made, and the consumers are asked to assist occasionally in weighing the ice delivered, in order to satisfy themselves that they are getting the full weights paid for. In short, the system is reduced to a cash basis as practiced by the "milk cart" and "bread wagon." Each transaction is complete in itself, the quantity of ice ordered is paid for when delivered, and the account is then and there settled in full.

NOTES ON PRICES.

——Hastings, Neb., ice dealers prophesy that ice will not be over 50c. a hundred this summer.

——The Union Ice Co., Colorado Springs, Colo., announces a rate of 25c. per cwt.—a material reduction from former prices.

——The appearance of the new National Ice Co. in the field at San Francisco and California promises to make competition lively for the ice trade of the Coast.

——It is announced that the price of ice for the season of 1892 at Santa Fé, N. M., will be 75c. per cwt., in small lots; 50c. in lots of fifty pounds and upward, daily.

——Weinberger & Hildebrandt, Rock Island, Ill., with 4,000 tons cut this harvest, announce a general price of 20c. per cwt., and think low prices will rule through the season.

——The managers of the leading companies at St. Paul announce that prices will remain about the same as last year. The family rate, daily service of twenty-five pounds, will probably be $2.50 per month.

——R. A. Beckett, of the City Ice Co., Montreal, Canada, the largest dealers in the Dominion, say there will be no increase of price this season to private families, though the wholesale price may be slightly higher.

——A leading ice dealer at Milwaukee is reported to have said: "Though we (the Wisconsin Lakes Ice Co.) have a very good crop, the cost of harvesting is always about the same. There was very little money in ice last year, and none the year before that. If the cold weather holds out, we will make a fair, legitimate profit this year."

ICY ITEMS.

——J. E. Koonce has bought the ice factory at Denton, Tex.

——John Dwyer has purchased the ice business of Ira Davis at Webster, Mass.

——N. Graf has purchased Wm. R. Owen's ice house property at Cresco, Iowa.

——Hussey Bros., Dover, N. H., have sold their ice business to Moses Chadbourne.

——Jos. Gardner has purchased Wm. Honeywell's ice business at Harlan, Iowa.

——Wing & Miller have purchased Cummerford's ice houses at New Hampton, Iowa.

——P. B. & Frank Brown have purchased the Anniston, Ala., ice factory; price, $25,000.

——The Michigan Central road filled its houses with ice from the Mackinaw straits.

——Myron Stearns has sold his ice houses at Rutland, Vt., to Eddy Bros., of Clarendon.

——Crawford & McGee have purchased Kinney & O'Mealia's ice house at Warsaw, N. Y.

——Frank Briggs has purchased the ice business of O. B. Titus at North Adams, N. Y.

——Ferguson Bros., Burlington, Vt., have sold out to the Consumers' Ice Co., for $8,000.

——Mauch Chunk, Pa., ice houses were filled at a cost averaging about $1.25 per ton.

——Wm. Reinhardt has sold out his interest in the ice company at Owensboro, Ky., to his partners.

——Henry Martin's ice house at Fairbury, Neb., has been sold by the sheriff to Davis & Butterbaugh.

——The Hygeia Ice Co. will itself control the delivery of its own ice at Frederick, Md., the coming season.

——Wm. Bridenstein has retired from the firm of Boney-steele & Bridenstein, ice dealers at Bellaire, Ohio.

——Military prisoners at Leavenworth, engaged in cutting ice, made a break for liberty. Only two got away.

——A. H. Babcock has purchased a controlling interest in the New England Ice Co., Orrington, 6,000 tons capacity.

——The Capital Ice Co., Denver, Colo., a new corporation, has begun business. They have 12,000 tons of new cut lake ice.

——The sale of the Danville (Ky.) ice factory plant, advertised to be sold February 16, was postponed until court day in March.

——The Union Ice Co. will handle at Los Angeles, Cal., the product of the ice factory of the Land and Power Co. of Ventura county.

——The Arctic Ice Co., Newport, R. I., has elected L. D. Davis, president; G. D. Reynolds, secretary; John Howard, treasurer.

——The Miami Ice Co., Hamilton, Ohio, have leased their Sheeley buildings, etc., to Jos. Fischer and Henry Isford until November 1, 1892.

——The St. Paul Ice Co., St. Paul, Minn., has elected H. T. Shelby, president; P. A. Lavalle, secretary and treasurer; Nicholas Hardy, general manager.

——The employes of the Crystal Ice Co., Kansas City, recently presented H. R. Clauss, manager, with a K. P. watch charm of gold, with diamond settings.

——The fuel oil tank at the Fish Artificial Ice Co.'s (Chicago) factory exploded February 16, and Engineer Clark was so terribly burned and bruised that he cannot recover.

——The Hygienic Ice Co., Washington, D.C., added $7,000 to the surplus fund last year; and January 19, elected S. W. Curriden, president, and F. P. Davis, secretary.

——Wages for ice cutters have been from $1.25 to $1.50 per day, these rates applying generally in all parts of the country with but little variation, with help plenty, as a rule.

——While cutting ice at Poultney, Vt., Jas. Hogan sawed a fish in two which was imbedded in the ice. The parts were afterward weighed and showed seven pounds and seven ounces.

——The Crystal Ice Co., of Fresno, Cal., has been incorporated; capital stock, $50,000; directors, J. W. Richards, W. H. McKenzie, F. K. Prescott, W. W. Eden and W. R. Thomas.

——The Port Angeles Packing Co. has been organized by Adolph Nicolai, Mary Easter and D. F. Clark, at Port Angeles, Wis.; capital, $50,000. The company will handle lake fish, salmon, etc.

——The Jas. Mix ice houses at Kankakee, Ill., 20,000 tons capacity, handling Chicago business, have been purchased by a stock company of which Lester Wheeler, late of Grant Park, is president.

——The advertising fake of freezing an actor's lithographs in blocks of ice has been improved on by an adventurous manager who had his star's "counterfeit presentment" molded in ice and promiscuously displayed at Philadelphia.

——C. H. Schadt has sold his ice works to the Maplewood Ice Co., Maplewood, Pa., for $30,000, one-half the amount paid in cash and one-half in stock. The business will be continued as the Consumers' Ice Co., C. H. Schadt, manager.

——The Baltimore Packing Co., Minneapolis, have been doing a large business catching fish in Basswood lake near Ely, Minn., this winter. The fishermen on an average take out of the lake about 1,000 to 1,200 pounds of fish per day, whitefish and trout.

——The Hygeian Ice Delivery Co., of Trenton, N. J., has been organized; capital, $10,000; to trade in ice, coal, etc.; R. V. Kuser, president; John Guild Muirheid, secretary; B. C. Kuser, treasurer and manager. This company will handle the entire product of the Hygeian Ice Co.

——A Davenport, Iowa, ice dealer said recently: "The ice business on the river (Mississippi), is played out except for local consumption. Shipping is the business that is dying out. Southern points prefer to use machine ice made from distilled water, not only for sanitary reasons but on the score of economy."

——Engineer Walter Tomlinson, of the Delaware Ice Co., Philadelphia, February 7, while adjusting a belt had his sleeve catch in the machinery and was whirled about on a pulley several times before the belt broke. Every stitch of clothing was torn from his body, and he was cut in the head; but, strange to say, he was not seriously injured.

——In answer to an inquiry about the Arctic Ice Machine Co., of Cleveland, we may say, on authority of A. St. J. Newberry, trustee, that contracts are being taken by him as trustee, both for repairs and for entirely new work; and that since his appointment he has built machines for Hannibal, Mo., Havana, Cuba, and has several contracts still on hand, the material for which he expects to ship shortly. It is likely that by April 1, the future of the business will be definitely known; whether it will be continued by a reorganized company or by the trustee, or whether it will be sold.

——The Central Ice Co., headquarters at Mobile, Ala., which operates a large number of ice factories in the South, held the annual stockholders' meeting at Mobile, February 8. The capital stock of the company is $629,000. The usual routine business was transacted, and the annual election held, the following directors being chosen: From Savannah, L. P. Hart, Samuel J. Whiteside, D. P. Daffin and Albert Hill; from Mobile, A. L. Lyon and Galard P. Clark; from Columbus, Judge W. H. Brannon; from Charleston, Sam Lapham; and from Boston, R. W. Hopkins. The directors elected the following officers: President, L. P. Hart; vice-president, S. J. Whiteside; treasurer, Samuel Lapham; and secretary, A. L. Lyon.

MEXICAN fruit has been coming into this country quite freely of late. Oranges, however, shipped in carload lots to Denver and Kansas City, have arrived in comparatively poor condition, though not much worse than a great deal of the Florida fruit received at the North. The Mexican orange is specially unfortunate in that it is a poor keeper. Since the last week in January, Mexican watermelons have been freely distributed in San Francisco. They looked magnificent, but many were perfectly tasteless and insipid. They sold, however, at $1 to $1.50 each.

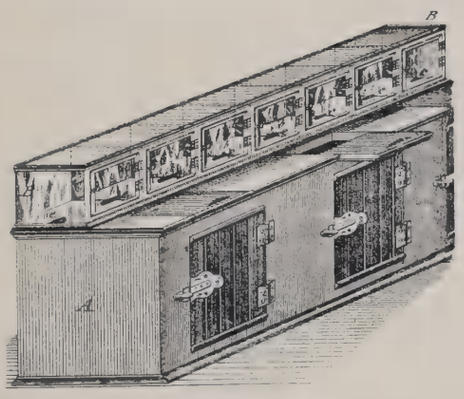


We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

COMBINED REFRIGERATING AND DISPLAY COUNTER.

No. 499,010. John C. Duhm, Emil Block, and Johann Sauter, New York, N. Y. Filed July 10, 1891. Serial No. 399,014. Patented February 16, 1892. (No model.)

Claim.—A combined refrigerating counter and display case comprising a counter provided with a refrigerator compartment, and a display case of less width than the

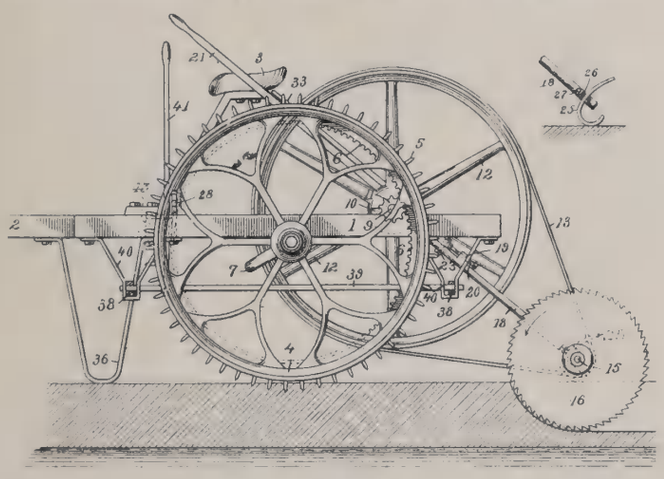


counter top, and disposed upon the front of the same and provided with transverse partitions forming a series of chambers, each chamber having a transparent front and a hinged door at its rear, and openings in the counter top, forming communication between the said refrigerator compartment and said chamber, substantially as described.

MACHINE FOR CUTTING ICE.

No. 467,189. Joseph S. Newell, Thomaston, Conn. Filed March 9, 1891. Serial No. 384,196. Patented January 19, 1892. (No model.)

Claim.—The driving shaft having belt pulleys 12, and shafts 15, mounted in blocks 17, said shafts carrying the saws and having belt pulleys 14, and belts connecting

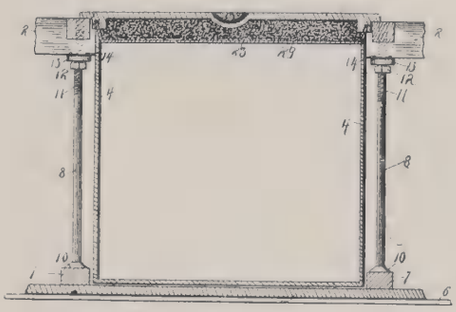


said pulleys, in combination with levers 21, which turn on the shaft and are provided with slots at their ends, rods 18, having lugs 19, bolts 23, passing through the slots in the levers and engaging rods 18, and screws 20, engaging the lugs and bearing against the ends of the levers, whereby shafts 15 may be moved in or out to tighten the belts.

LID AND SUPPORTING FRAME WORK FOR ICE CANS.

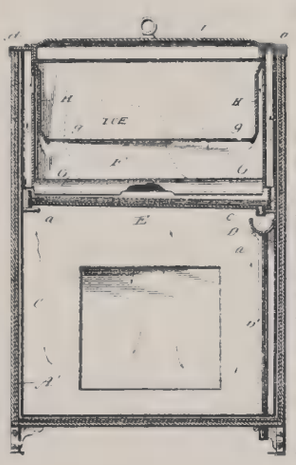
No. 467,406. William H. Glover, St. Louis, Mo. Filed August 19, 1891. Serial No. 403,111. Patented January 19, 1892. (No model.)

Claim.—The herein-described wooden structure and support for ice can lids and ice cans, having intersecting joists and cross timbers 1 and 2, respectively, on which the ice can lids are supported, timbers 7, running parallel with each other and with said joists, supporting posts 8, provided with basic portions 10, mounted on



timbers 7, angular screw threaded nuts mounted on the upper portions of said posts, non-rotatable washers 14, interposed between said angular nuts 12 and the timbers to be supported, and a wooden bottom 5, placed on the metallic bottom 6 of the exterior tank, on which the ice can 4 may be placed, thereby preventing the bottom of said can from being worn away by abrasion, substantially as set forth.

REFRIGERATOR.



No. 467,225. Laban J. Everest and Henry C. Betterman, Omaha, Neb. Filed April 21, 1891. Serial No. 389,813. Patented January 19, 1892. (No model.)

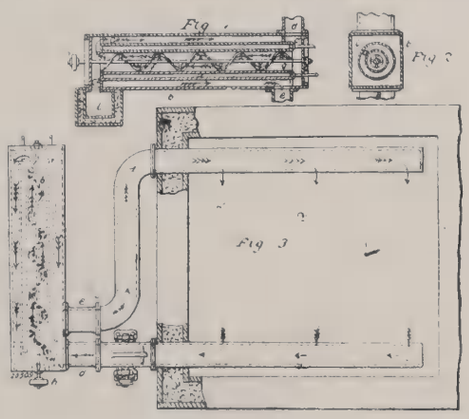
Claim.—In a refrigerator, an ice chamber having its bottom formed of separated bars, air spaces at the ends, a surrounding flange to embrace the walls of the box or case, openings through the end walls of the chamber, and deflecting plates independent of the said bars of the ice rack, within the chamber adjacent to said openings, with their lower ends unattached, substantially as specified.

FOREIGN PATENTS.

REFRIGERATING APPARATUS.

No. 20,509. F. B. Hill, London. (11d. 8 Figs.) December 16, 1890. Accepted December 16, 1891.

Claim.—A refrigerating chamber *a* of annular form is supported centrally within a casing *b*. The space *c* between the chamber *a* and the casing *b* is closed at one



end by a partition c^1 and is partially closed at the other end by a partition c^2 having apertures c^3 in it. The cas-

ing is provided with an inlet pipe *d* and an outlet pipe *e*. To remove the hoar frost from the interior of the refrigerating chamber *a*, a screw conveyor *f* is arranged to rotate in contact with the wall. This screw conveyor is mounted upon a shaft *g* provided with a band pulley *h*. The screw conveyor serves also as a conveyor for withdrawing the hoar frost from the space inclosed by the chamber into a box *i*, whence it may be removed to be utilized for cooling purposes. The air to be cooled, which is either forced or drawn through the apparatus by a blower or fan, enters by the inlet pipe *d* and flows through the space inclosed by the chamber *a* in contact with the interior wall of the chamber, the screw *f* tending to cause the air to travel in a helical path; the air then passes through the apertures c^3 and flows through the space *c* in contact with the exterior of the chamber, and is discharged through the outlet pipe *e*. Any moisture contained in the air will be deposited chiefly upon the inner wall of the chamber *a*, and will be converted thereon into hoar frost, which will be removed as it is formed by the screw.

ROCHESTER, N. Y., seems to have succeeded to the "ice palace" fun, so lately the peculiar property of St. Paul. The palace had a frontage of forty feet, and was thirty feet high. Eighty firms were represented in the industrial parade, which was followed by an imitation of the southern Mardi-Gras festivities, a ball, and the storming of the palace. It was "lots of fun"; but then Rochester does not have a six months' winter with four months more of "blamed early in the spring" and deuced late in the fall weather—that is, not every year!

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $3 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Partner Wanted.

Wanted, partner to join advertiser in erecting 4-ton ice plant in some suitable town on Atlantic coast. Address "C. J. C.," care Carrier 12, Baltimore, Md.

Five-Ton Ice Machine Wanted.

Wanted, a 5-ton second-hand ice machine. Must be in good running order. Address, stating name of maker, location, price, etc., "S. G. P.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

For Sale at a Bargain.

A new 15-ton ice or refrigerating plant, consisting of one 14x30 Corliss engine, and one 12x24 ammonia compressor; 10,000-lb. fly wheel and foundation plates. Address FRANK TOOMEY, 131 N. 3d st., Philadelphia, Pa.

Draughtsman Wanted.

A mechanical draughtsman for refrigerating and ice machine work. Must have practical knowledge and experience in laying out pipe work. Address "C. B. R." care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Engineer Wanted.

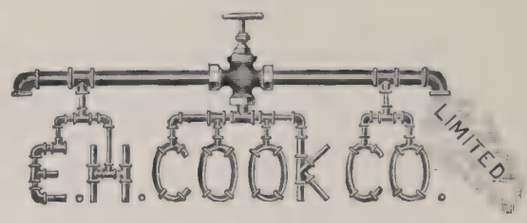
A first-class engineer with steady habits and good references, who is experienced and thoroughly competent to take charge of a 60-ton ice making and cold storage plant, located in Illinois. Address COL. D. J. FOSTER, 132 La Salle st., Room 31, Chicago.

Position Wanted.

A young man with nine years' experience in the cold storage business, wishes a position as superintendent or manager of a cold storage plant. Thoroughly understands everything pertaining to the running and conducting of a first-class storage house. Can furnish the best of references as to character and ability. Address "J. A. S.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Construction of Cold Storage Plants.

My articles in this magazine having drawn applications from parties about the country for erecting cold storage plants for them, upon my system, as outlined in August number of this magazine, I have disposed of my plant and arranged to meet this demand by contracting to construct such plants, affording command of temperatures and dryer air than any other ice system can give. Correspondence solicited. D. B. BEEMER, Omaha.



ENGINEERS AND CONTRACTORS FOR

Hot Water and Steam Heating

Ventilating

ALSO ALL KINDS OF PIPING FOR

BREWERIES

WATER, STEAM AND GAS.

Greenhouse Heating & Steam Laundry Work

PUMPS

DAMPER REGULATORS, FEED WATER HEATERS, AND ALL KINDS OF ENGINEERS' SUPPLIES.

92 and 94 Andrews Street,

ROCHESTER, N. Y.

The Fluoride Compound Purifies Water.

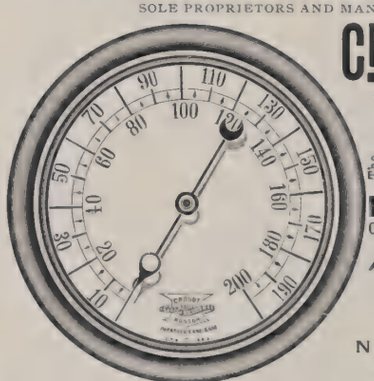
Prevents and removes incrustations in boilers.
Is economical, harmless and easy to handle.
May be kept in paper or wood indefinitely.

AMERICAN FLUORIDE CO.

126 LIBERTY STREET, NEW YORK.

Crosby Steam Gage & Valve Co.

SOLE PROPRIETORS AND MANUFACTURERS OF



CROSBY Pop Safety Valves. Water Relief Valves. Steam Pressure Gages. Steam Engine Indicator.

Victory Steam Cylinder Lubricators, Single Bell Chime Whistles, Patent Gage Testing Apparatus.

The BOSWORTH Pump Governor. Pressure Regulator and Feed-Water Regulator.

Clark's Linen Fire Hose and Couplings and many other Specialties.

AMMONIA GAGES

And all other Pressure and Vacuum Gages used in the Arts.

BRANCHES:
NEW YORK, CHICAGO, and LONDON, ENG.

Main Office & Works: BOSTON, MASS., U. S. A.

A PENNY SAVED

Is a penny earned. If your brine pipes can be made to do longer service, or your other iron work, such as condensing tanks, etc., will look better, why not use the material that will do this? which is the cheapest good black ever made. Write us for particulars. We sell to nearly every brewer and ice machine plant in Chicago, and hundreds elsewhere.

Write us for letters from users, etc.

77 Warren St., NEW YORK.

BONNELL'S NUBIAN IRON ENAMEL

THE NUBIAN IRON ENAMEL CO., 17 TO 19 NUBIAN AVENUE, (A CHICAGO SUBURB.) CRAGIN, ILL.

IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD,*** free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

KEYSTONE CHEMICAL CO.

Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate.

Yours truly,
CHAMPION ICE MFG. & COLD STORAGE CO.
R. W. DUGAN, Sup't and Treas.
(COPY)

T. B. WRIGHT & CO.

ESTABLISHED 1824

SUCCESSORS TO CHARLES WRIGHT.

MANUFACTURERS OF.....

RE-CARBONIZED GRANULATED .·. **CHARCOAL** .·.

For Filtering and Artificial Ice Manufacturing

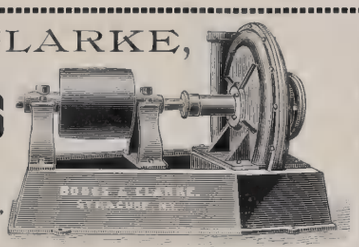
Samples and Prices sent on application.

BERLIN, N. J. Office, 117 Wood St., Philadelphia, Pa.

BOGGS & CLARKE,

MANUFACTURERS OF

Centrifugal Pumps



FOR CIRCULATING BRINE
And all other Liquids.
123 & 125 SOUTH CLINTON STREET,
SYRACUSE, N. Y.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

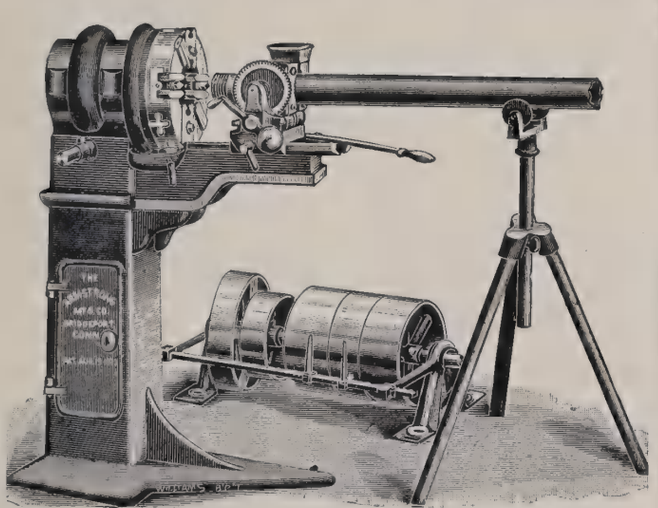
Cor. Charles and Plum Sts.,
CINCINNATI, O.

ARMSTRONG MAN'F'G. CO.



WATER GAS AND STEAM FITTERS TOOLS

BRIDGEPORT, CONN.



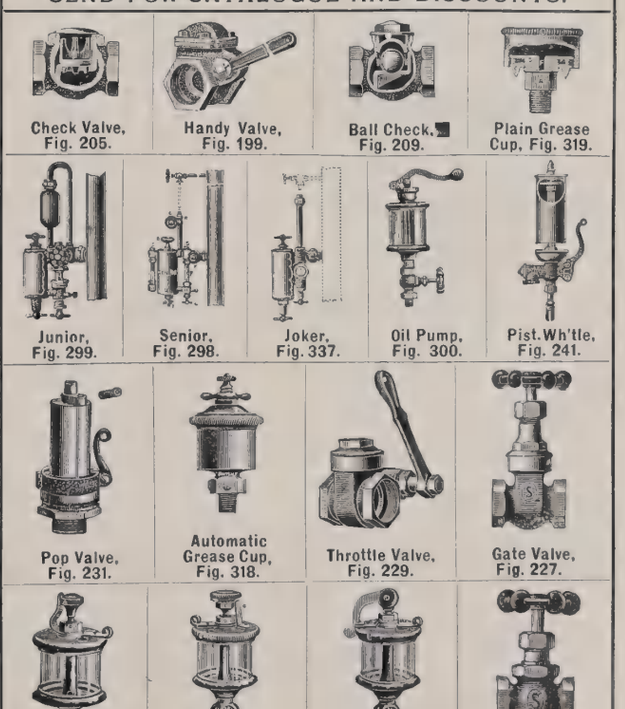
Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

EVERY ONE A GEM. EVERY ONE POPULAR.
IT WILL PAY YOU TO INVESTIGATE THE

LUNKENHEIMER .·. SPECIALTIES

STRICTLY FIRST-CLASS AND WARRANTED.
SEND FOR CATALOGUE AND DISCOUNTS.



Check Valve, Fig. 205. | Handy Valve, Fig. 199. | Ball Check, Fig. 209. | Plain Grease Cup, Fig. 319.

Junior, Fig. 299. | Senior, Fig. 298. | Joker, Fig. 337. | Oil Pump, Fig. 300. | Pist. Wh'tle, Fig. 241.

Pop Valve, Fig. 231. | Automatic Grease Cup, Fig. 318. | Throttle Valve, Fig. 229. | Gate Valve, Fig. 227.

Pioneer, Fig. 305. | Royal, Fig. 306. | Crown, Fig. 308. | Globe Valve, Fig. 200.

FOR SALE BY DEALERS, OR WRITE
THE LUNKENHEIMER BRASS MFG. CO., Cincinnati, O., U. S. A.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission,
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

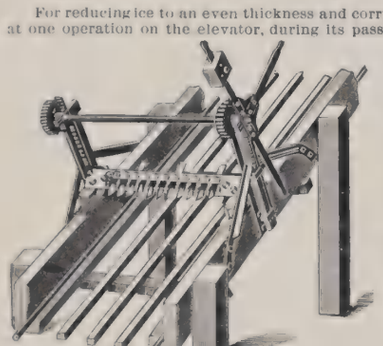
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house



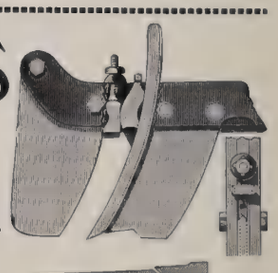
It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

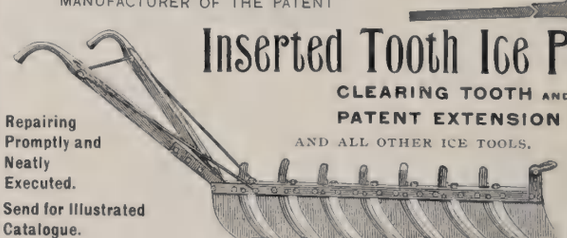
ICE TOOLS



HENRY BODENSTEIN,
MANUFACTURER,
Staatsburg, Dutchess Co., N. Y.

MANUFACTURER OF THE PATENT

Inserted Tooth Ice Plows



CLEARING TOOTH AND PATENT EXTENSION GAUGE

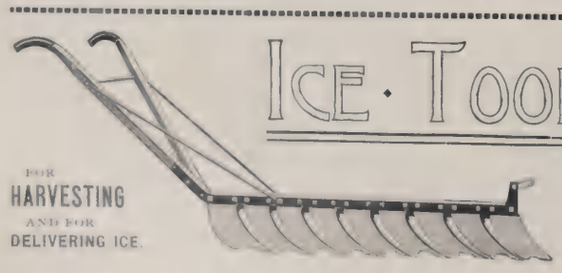
AND ALL OTHER ICE TOOLS.

Repairing Promptly and Neatly Executed.

Send for Illustrated Catalogue.

All Work Warranted to Give Satisfaction

ICE TOOLS



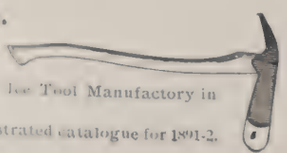
FOR HARVESTING AND FOR DELIVERING ICE.

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.

Send for complete illustrated catalogue for 1891-2.

PETER GERLACH & CO.

CLEVELAND, OHIO.

MANUFACTURERS OF THE FINEST

ICE TOOLS

.....FOR.....

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.



SEND FOR PRICE LIST.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

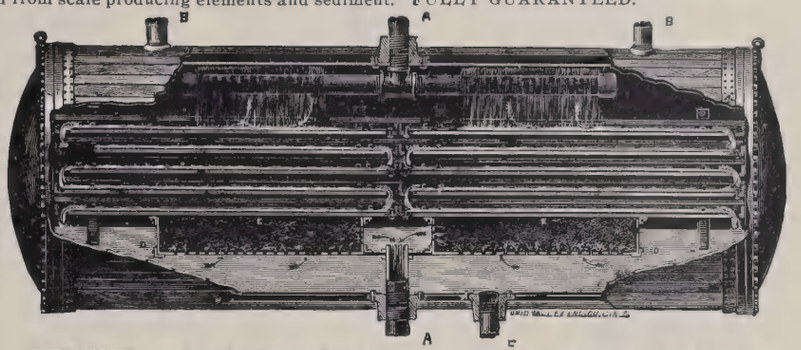
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

F. L. GALIGHER,

Consulting Expert

.....IN. ....

ICE AND REFRIGERATING MACHINERY

Capacity of Plants Increased

AT A MINIMUM COST.

REPAIRS AND ALTERATIONS MADE.

Perfected Distilled Water Apparatus

FOR . . . ICE FACTORIES, PURE WATER COS. A SPECIALTY . . .

Manufacturers' Agent

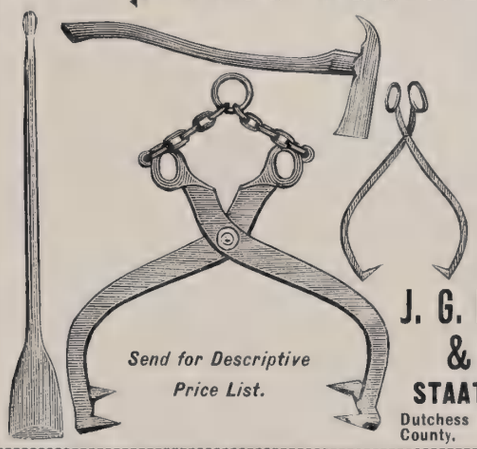
ELECTRIC LIGHT MACHINERY, BOILERS, ENGINES, AMMONIA, ETC.

Correspondence Solicited.

Cor. Scott and Denison Streets,

GAINESVILLE, TEXAS.

THE Improved Vaulting Tong



Send for Descriptive Price List.

Steel Hoisting Tong,
Steel Hand Tong,
Ice Axes, Ice Hooks,
Wagon Ice Runs,
Circle Ice Runs,

And all other Tools used in the Ice Business.

MANUFACTURED BY

J. G. BODENSTEIN & CO.

STAATSBURG, Dutchess County, **NEW YORK.**

CRANE COMPANY, CHICAGO.

SPECIAL **WROUGHT IRON PIPE**

. . . . . For Ice Making and Cold Storage.

A. W. SWANITZ, CONSULTING ENGINEER, AND EXPERT IN

Ice AND Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

J. M. WESTERLIN. ALLAN CAMPBELL.

WESTERLIN & CAMPBELL,

Consulting Engineers & Contractors

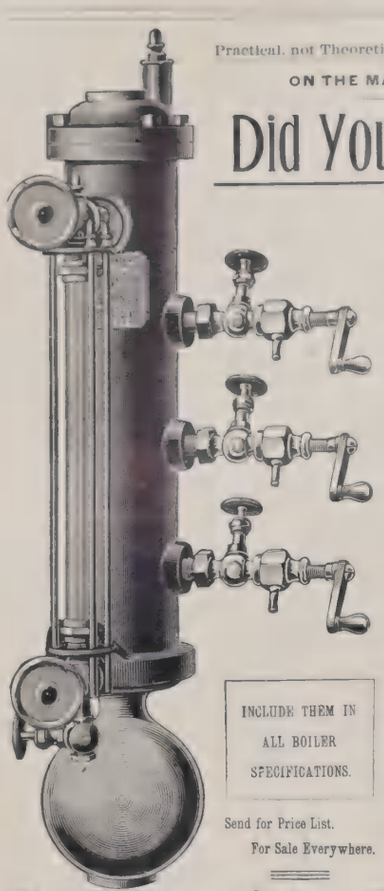
FOR

ICE MAKING AND REFRIGERATING MACHINERY,

26 West Lake Street, Room 11,

CHICAGO.

AMMONIA FITTINGS AND ICE MACHINE SUPPLIES. PIPE WORK, REPAIRS, TESTS AND ALTERATIONS A SPECIALTY. PLANS, SPECIFICATIONS AND ESTIMATES PROMPTLY FURNISHED.



Practical, not Theoretical . . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.
For Sale Everywhere.

The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.
101 EUCLID AVE., CLEVELAND, O.

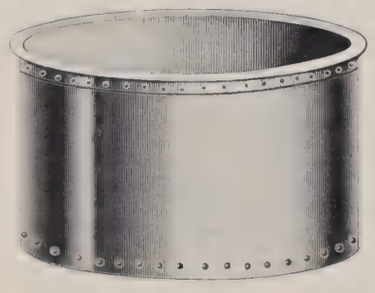
ATTENTION, CREAMERIES!!!

THE Alexandria Improved Jumbo Separator . .



THE ALEXANDRIA IMPROVED JUMBO SEPARATOR has the largest capacity of any machine in the world, with this size bowl, viz.: 15. With a speed of 6,500 revolutions per minute it will separate 2,500 to 3,000 lbs. per hour. Two horse power will run it. We guarantee this machine in every respect; material, workmanship and separation of cream perfect. The bowl of this separator is forged from steel made especially for this machine. If you need a large separator, call on us. We control the Nelson & Peterson and the Stephens Patent for the U. S. of the Alexandria and Jumbo Separators.

DAVIS & RANKIN BLDG. AND MFG. CO.
240 TO 254 WEST LAKE STREET, CHICAGO.

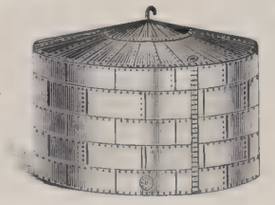


WM. GRAVER TANK WORKS.

INCORPORATED

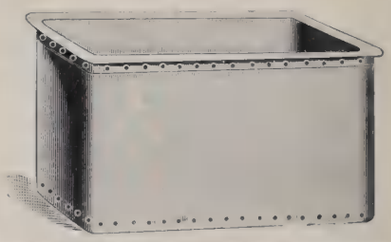
MANUFACTURERS OF .....

IRON AND STEEL **STORAGE TANKS**



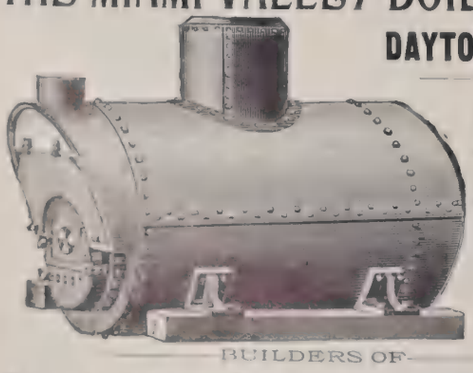
WORKS:
EAST CHICAGO, IND.
ON BELT LINE. CONNECTING WITH ALL CHICAGO RY'S.

OFFICES
334 & 336 Rookery,
CHICAGO, ILL.



THE MIAMI VALLEY BOILER CO.

DAYTON, OHIO.



We guarantee all work to be first-class and prompt.

ESTIMATES GIVEN.

PLEASE ASK FOR PRICES.

BUILDERS OF

Stand Pipes, Boilers and Ice Tanks.

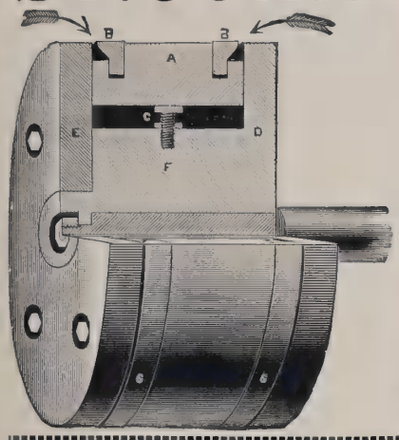
TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF
ICE MAKING AND COLD STORAGE PLANTS.

ST. JOHN CYLINDER PACKING CO.



MANUFACTURE A PACKING SPECIALLY ADAPTED TO ALL CLASSES AND SIZES OF . . . . . .

MARINE, LAND AND LOCOMOTIVE ENGINES, AIR COMPRESSORS, WATER, OIL AND AMMONIA PUMPS.

Insures perfectly tight pistons with minimum friction, and is self-adjusting. It increases the power of engines ten per cent, and saves fuel, oil and cost of repairs. It wears the cylinder round and true, and renders reboring unnecessary.

Highest and only awards International Exhibitions, Edinburgh and London, 1890; Special Medal of Superiority, American Institute, New York, 1888 and 1889; Massachusetts Charitable Mechanics' Association, Boston, 1890.

SEND FOR DESCRIPTIVE CIRCULARS AND PRICE LIST.

D. DeKREMEN, Sales Agent 280 Broadway, NEW YORK.



GLOBE ∴ PACKING

FOR REFRIGERATING AND ICE MACHINES.

THE..... BEST PACKING MADE FOR.....

STEAM, WATER AND AMMONIA

None genuine without the TRADE MARK on the muslin cover. Ask your supply dealer for it or order direct.

SEND FOR SAMPLE.

Manufactured only by J. H. BILLINGTON & CO., PHILADELPHIA, PA.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

69 FRANKFORT,

CLEVELAND, OHIO.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES.



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

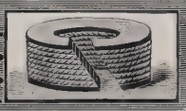
RANDOLPH BRANDT, 38 Cortlandt St., New York. U. S. A.

THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKING IS USED.



EQUALED BY NONE







MAIN OFFICE

PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

AMMONIA ROD PACKING

Saves Fuel

ANTI-FRICTION METALLIC PACKING

CHEAP LASTS FOR YEARS CHEAP

Frictionless

AT LAST A PACKING HAS BEEN INVENTED THAT WILL

PACK AMMONIA RODS

Satisfactorily and Economically.

ALL KINDS OF PISTON RODS PACKED.

ILLINOIS METALLIC PACKING CO.

103 TRADERS' BUILDING,

Send for Price List and Description. CHICAGO.

READ WHAT ONE OF OUR CUSTOMERS SAYS.

CHICAGO, December 12, 1891.

ILLINOIS METALLIC PACKING CO., CHICAGO.

GENTLEMEN: In reply to yours of recent date, am glad to be able to state that the Ammonia Rod you packed with your Anti-Friction Metallic Packing is running very satisfactory. *After a trial of a number of other packings on this rod,* none of which were a success, I can truthfully state that I *consider your packing as being unequaled for ammonia rods, as well as for other rods, pumps and engines.* Wishing you the success you deserve with your packing, I am, Yours respectfully,

CHAS. B FAIR, Chief Engineer,
CONSUMERS' PURE ICE CO.

JAMES A. MILLER & BRO.

129 and 131 South Clinton Street,

CHICAGO.

SLATE, TIN AND IRON

ROOFERS

MANUFACTURERS OF

Ice Cans



ALSO . . .

CORRUGATED AND OTHER IRON ROOFINGS,
SHEET METAL SKYLIGHTS,
CORRUGATED CONDUCTORS, Etc.

All GENUINE INGOTS MANUFACTURED BEAR OUR REG. TRADE MARKS



PHOSPHOR-BRONZE

INGOTS, CASTINGS, WIRE, SHEET &c.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND SOLE MAKERS OF "ELEPHANT BRAND" PHOSPHOR-BRONZE

D. F. KENLY & CO.

ICE MACHINE
and BREWERS' WORK
A SPECIALTY.

Galvanizers

188 & 190 NORTH UNION ST., CHICAGO.

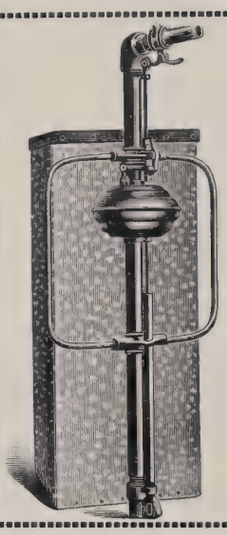
THE CANTON STEEL ROOFING CO.

.....MANUFACTURERS OF....

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

Canton, Ohio.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.



A. H. PEIRCE MFG. CO.

S. W. Corner Kinzie and Green Streets,

CHICAGO

WE MANUFACTURE ALL THE GALVANIZED IRON APPLIANCES USED IN ICE MAKING AND REFRIGERATING PLANTS

HEREWITH WE APPEND EXTRACT FROM A LETTER FROM ONE OF OUR CUSTOMERS . . . . . .

OFFICE OF HERCULES IRON WORKS.

A. H. PEIRCE MFG. CO. CHICAGO, January 19, 1892.

Gentlemen: * * * For three years we have bought largely from you our supply of ice cans and other galvanized iron work used in our plants, with uniform satisfaction to ourselves and our customers, and cheerfully recommend you in this instance.

* * * *

HERCULES IRON WORKS.

ESTIMATES SUBMITTED.
CORRESPONDENCE INVITED.....

ICE CANS, COLD STORAGE TANKS, BRINE PIPES, FILTERS, CONDENSERS, ETC.



CRANDALL'S PATENT PACKINGS

FOR STEAM, WATER AND AMMONIA.

Not having been subjected to the injurious chemical action of burning oil, outlast all others, and never melt and gum. Perfect lubrication, least friction, greatest expansion, and superior durability, the verdict wherever comparative tests have been made.

WE HOLD THE ONLY PATENTS ON COLD LUBRICATION, AND OUR GOODS ARE GUARANTEED FOR ALL PLACES WHERE PACKING IS USED.

Send for Descriptive Catalogue and Samples.

NEW YORK: 136 Liberty St.
CHICAGO: 28 S. Canal St.

CRANDALL PACKING CO.
PALMYRA, N. Y.

GEIGER, FISKE & CO.

MANUFACTURERS OF



ICE CANS

According to Specifications Furnished.

Sheet Iron and Tank Work

OF EVERY DESCRIPTION, FOR

ICE MFRS., COLD STORAGES, PACKERS, BREWERIES, ETC.

ALSO

Boilers, Smoke Stacks, Etc.

715 to 739 East Main Street, **LOUISVILLE, KY.**

AJAX METAL CO. PHILADELPHIA, PA.

J.G.HENDRICKSON, F.J.CLAMER, CO PARTNERS.

AJAX BEARINGS DON'T GET HOT.

GRAPHITE

SEND FOR OUR CIRCULAR.

PIPE JOINT GREASE

INSTEAD OF RED LEAD.

GUARANTEED MANY TIMES BETTER.

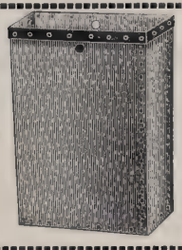
JOS. DIXON CRUCIBLE CO.

JERSEY CITY, N. J.

DUNLEVY SHEET IRON WORKS

Galvanized Iron . .

ICE CANS



And all Sheet Iron Tank Work for ICE FACTORIES.

WRITE FOR ESTIMATES.

515 NORTH LEVEE, ST. LOUIS.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

ST. LOUIS, MO.

WINGATE & MELL,

MANUFACTURERS OF : : : **ICE.CANS**

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, **ATLANTA, GA.**

· WRITE · FOR · PRICES ·



Capacity, 300 per day.

GALVANIZED STEEL

ICE.CANS

OVER 65,000

OF OUR CANS IN USE, AND DISTRIBUTED IN 22 STATES, AS FOLLOWS:

ALABAMA
DISTRICT OF COLUMBIA
FLORIDA
GEORGIA
ILLINOIS
INDIANA
KANSAS
KENTUCKY
LOUISIANA
MISSISSIPPI
MISSOURI
NEW JERSEY
NEW YORK
NORTH CAROLINA
OHIO
OKLAHOMA TERRITORY
PENNSYLVANIA
TENNESSEE
TEXAS
VIRGINIA
WEST VIRGINIA
WISCONSIN

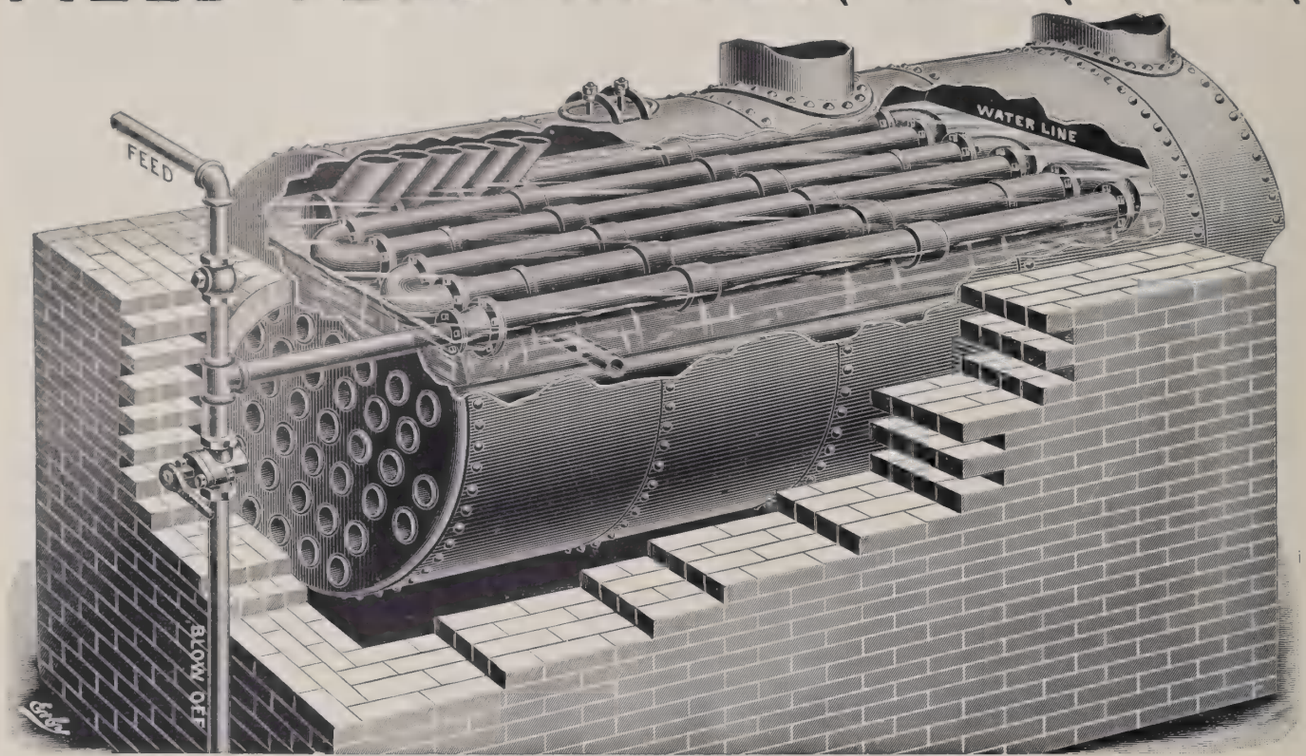
ESTABLISHED 1861. CHRIS. KIECHLER, PRESIDENT. **INCORPORATED 1890.**

THE KIECHLER MFG. CO.

Sheet Metal Works

LINN, EVERETT AND CLINTON STS. CINCINNATI, O.

FIELD FEED WATER PURIFIER



MOST ECONOMICAL LIVE STEAM PURIFIER.

Removes all impurities from feed water before entering circulation of boiler. Can be *applied* in *one day*. Connection made with regular feed. Keeps boilers clean without boiler compounds. Extends period between wash outs four to ten times.

Office, 134 Van Buren St. **CHICAGO, ILL.** *Factory, 43d St. and Stewart Ave.*

AUG. MARITZEN,

Engineer and Architect

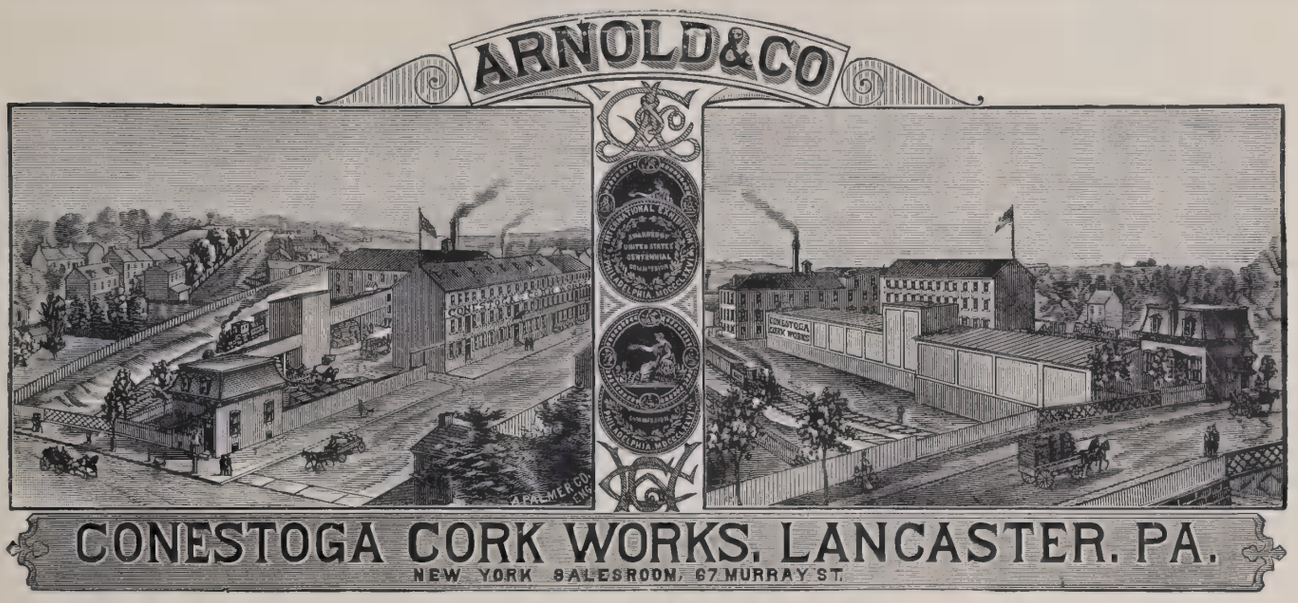
WILL FURNISH ON SHORT NOTICE ALL PLANS, SPECIFICATIONS AND ESTIMATES FOR COMPLETE . . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE,
Chicago, Ill.

BEST OF REFERENCES FURNISHED AND SATISFACTION GUARANTEED. . . . .



CONESTOGA CORK WORKS, LANCASTER, PA.

NEW YORK SALESROOM, 67 MURRAY ST.

MANUFACTURERS OF ALL KINDS OF MACHINE CUT CORKS

Granulated Cork For Insulating Purposes

Our productions were awarded the First Premium at the Great Centennial for Uniformity and Quality. . . . .

GIVE US A TRIAL ORDER AND BE CONVINCED.

ADDRESS ALL COMMUNICATIONS TO . . . . . CONESTOGA CORK WORKS, OR TO ARNOLD & CO.

B. G. DODGE

MANUFACTURER OF EVERY DESCRIPTION OF MACHINE-CUT CORKS

FOR INSULATING PURPOSES A SPECIALTY

GRANULATED CORK



PROPRIETOR OF LANCASTER CORK WORKS

LANCASTER, PA.

ARMSTRONG, BRO. & CO.

INCORPORATED

MANUFACTURERS OF GRANULATED CORK FOR

INSULATING PURPOSES

THE MOST PERFECT AND DURABLE INSULATING MATERIAL KNOWN FOR FILLING ICE HOUSES, REFRIGERATORS, COLD STORAGES ETC.

ALSO MANUFACTURERS OF

MACHINE CUT CORKS COMPRESSED POPLAR BUNGS, PLUGS AND TAPS.

FOR PARTICULARS AND ESTIMATES ADDRESS

ARMSTRONG BROTHER & CO. INCORPORATED, PITTSBURGH, PA.
THE ARMSTRONG BROTHERS CO. NEW YORK.
FAY-ARMSTRONG CORK CO. CHICAGO.
ARMSTRONG-GILBERT CORK CO. ST. LOUIS.

Granulated Cork

FOR INSULATING PURPOSES

THE CLEANEST AND BEST IN THE MARKET.

Send for prices and samples.

DAVID KAHNWEILER, 146, 148 and 150 Worth Street, NEW YORK CITY.



Ice and Refrigerating Machinery

OILS

IAS. DALZELL & SON CO. PITTSBURGH, PA.

THE B. F. GOODRICH CO.

AKRON RUBBER WORKS, AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

HOSE OF HIGH QUALITY FOR ICE FACTORIES AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds, Belting, Valves, Etc.

SPECIALTIES TO ORDER. Samples and Prices upon Application.

GROUND CORK

FOR INSULATING PURPOSES.

For Cold Storage Rooms, Refrigerator Cars, Brewers, and all [illegible] purposes. Large Stock on hand which will be supplied at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non-conductor of heat in all dry storage rooms and situations. They are **FIRE-PROOF**, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .

WRITE FOR SAMPLES AND FULL PARTICULARS ON

BEST INSULATING MATERIAL



For ∴ COLD STORAGE WAREHOUSES, AND REFRIGERATOR CARS, ICE HOUSES, AND ALL REFRIGERATION

Extensively Used and Highly Endorsed by Experts.

NEPONSET WATER-PROOF FABRICS

F. W. BIRD & SON, SOLE MANUFACTURERS, East Walpole, Mass.

S. E. BARRETT MFG. CO., CHICAGO, Western Agents.

P & B Waterproof Insulating Papers

ARE THE BEST MADE

They contain **NO TAR**, are **ODORLESS** and **CLEAN TO HANDLE**, made from the best of paper stock; used by the largest and most prominent cold storage and refrigerating plants in the **WORLD.**

P. & B. PRESERVATIVE COMPOUNDS For insulating **walls** and preserving all kinds of **iron** and **wood work** exposed to **dampness**, acids or alkalies. The material is very **penetrating**, always remains **elastic**, will not chip or peel off. **THE P. & B. No. 2. PAINT** is the **most perfect** coating for **coils, tanks,** etc.

TRADE P B MARK REGISTERED

STANDARD PAINT CO. 2 LIBERTY STREET, NEW YORK.

Owners of **P. & B.** patents and sole manufacturers of all the **P. & B.** products.

CHICAGO OFFICE: 542 The Rookery. ∴ THE PARAFFINE PAINT CO., Manufacturers for the Pacific Coast, 111 Battery St., SAN FRANCISCO, CAL.

THE NEW WEBSTER

A GRAND INVESTMENT for every Family and School.

A New Book from Cover to Cover.

WEBSTER'S INTERNATIONAL DICTIONARY

Revision cost over $300,000.

SUCCESSOR OF THE UNABRIDGED.

Ten years revising. 100 editors employed. Critical examination invited. Get the Best.

SOLD BY ALL BOOKSELLERS.

Pamphlet of specimen pages, engravings and testimonials sent free by the publishers,

G. & C. MERRIAM & CO., Springfield, Mass.

Insulating Linings

EVERY VARIETY FOR REFRIGERATORS, REFRIGERATOR CARS AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

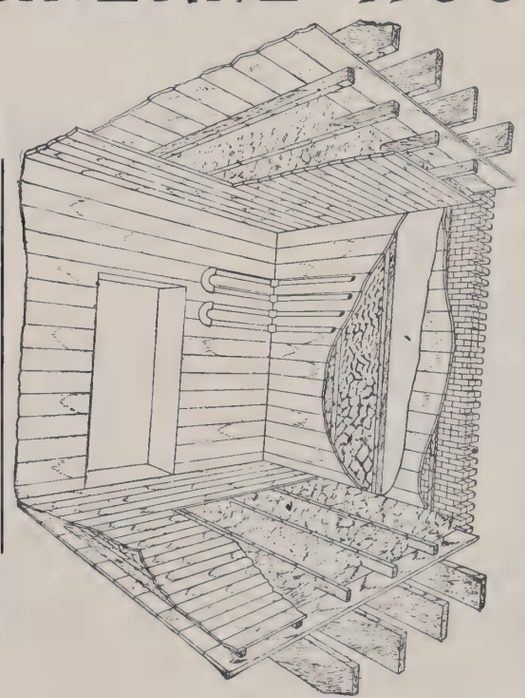
SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

MINERAL WOOL

COLD STORAGE, BREWERIES



INSULATION

.... ICE PLANTS ∴ REFRIGERATORS. ....

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

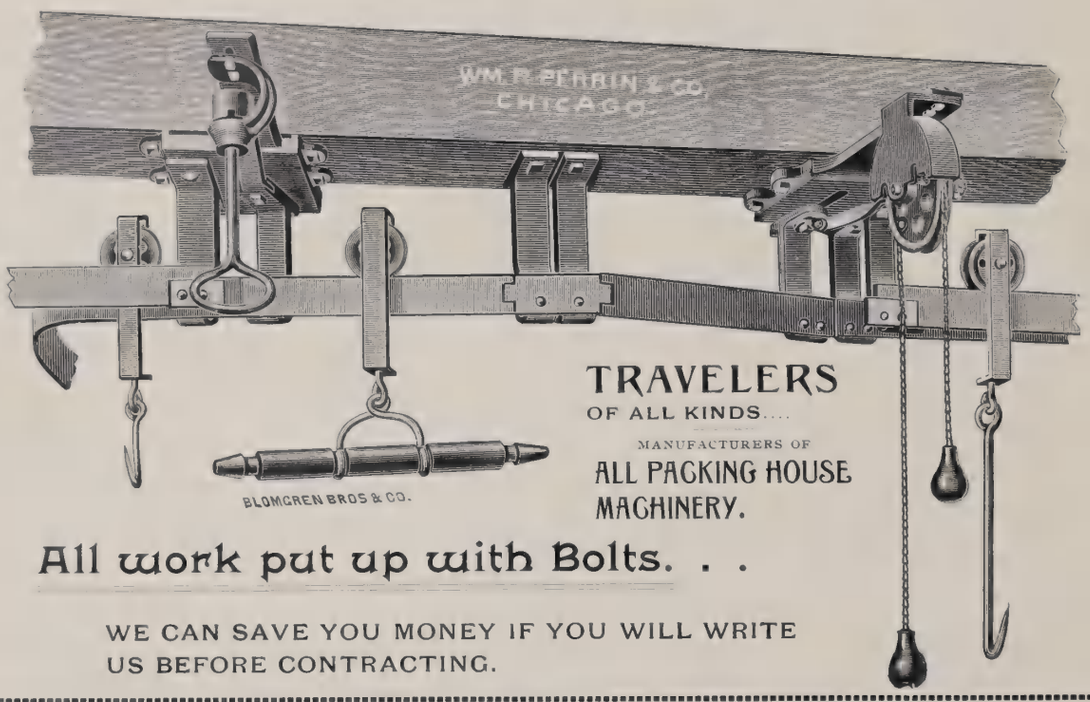
WM. R. PERRIN & CO.

CHICAGO

ALL WORK GUARANTEED

Overhead Railway

. . . 75,000 FEET OF RAIL PUT IN DURING 1891 . . .



TRAVELERS
OF ALL KINDS....

MANUFACTURERS OF
ALL PACKING HOUSE MACHINERY.

All work put up with Bolts. . .

WE CAN SAVE YOU MONEY IF YOU WILL WRITE US BEFORE CONTRACTING.

Mineral Wool

BEST INSULATOR FOR . . . . .

ICE HOUSES,
COLD STORAGE ROOMS,
ETC.

REFERENCES ON APPLICATION.
SAMPLES FREE . . . . . U. S. MINERAL WOOL CO. 2 CORTLANDT ST., N. Y. CITY.

BIRD'S SHEATHING

ESPECIALLY PREPARED FOR USE IN
REFRIGERATORS AND COLD STORAGE

THE ONLY WATERPROOF
... INSULATING PAPER
That will not Deteriorate with Age.

SEND FOR SAMPLES AND PRICES . . . . . THE BIRD PAPER MFG. CO., 149 & 151 Church St. NEW YORK.

PHOSPHOR BRONZE BEARINGS

SPECIALLY FOR

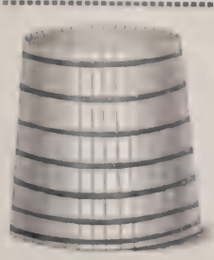
ICE MACHINES

MANUFACTURED BY

PAUL S. REEVES

PHILADELPHIA.

BRASS AND PHOS BRONZE CASTINGS FROM 2 LB TO 2000 LBS IN WEIGHT

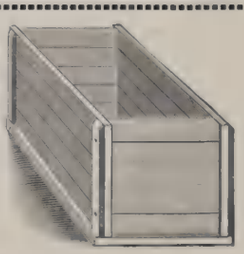


GEO. WOOLFORD, Manufacturer of all kinds of

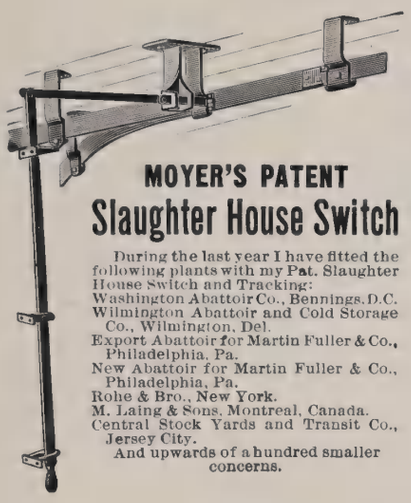
Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES,
COLD STORAGE HOUSES
RAILROADS, PACKERS,
CHEMICAL WORKS, ETC.



2240, 2242 and 2244 North 9th Street, PHILADELPHIA.



MOYER'S PATENT

Slaughter House Switch

During the last year I have fitted the following plants with my Pat. Slaughter House Switch and Tracking:
Washington Abattoir Co., Bennings, D.C.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
Export Abattoir for Martin Fuller & Co., Philadelphia, Pa.
New Abattoir for Martin Fuller & Co., Philadelphia, Pa.
Rohe & Bro., New York.
M. Laing & Sons, Montreal, Canada.
Central Stock Yards and Transit Co., Jersey City.
And upwards of a hundred smaller concerns.



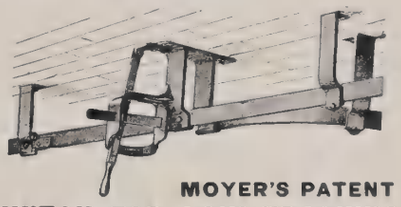
J. W. MOYER,

Office, 1217 Filbert St., Room 105,
Factory, 1216 Cuthbert Street, PHILADELPHIA.

MANUFACTURER OF

Overhead Tracking Switches AND Trolleys for Abattoirs, Refrigerators and Packing Houses

When using this Hanger the track is not required to be drilled, as it is held in position by a clamp bolt, thereby saving the cost of drilling. It affords a cheap and simple manner of erecting the tracking.



MOYER'S PATENT

SWITCH FOR LOW TRACKING.

Generally used where quarters of beef, hogs, or sheep are stored, and can be set up in any part of the room. It is fitted up and put together at the factory, so all that is necessary to erect it is to fasten the hanger to the ceiling and the switch is ready for use. This can be done in twenty minutes.

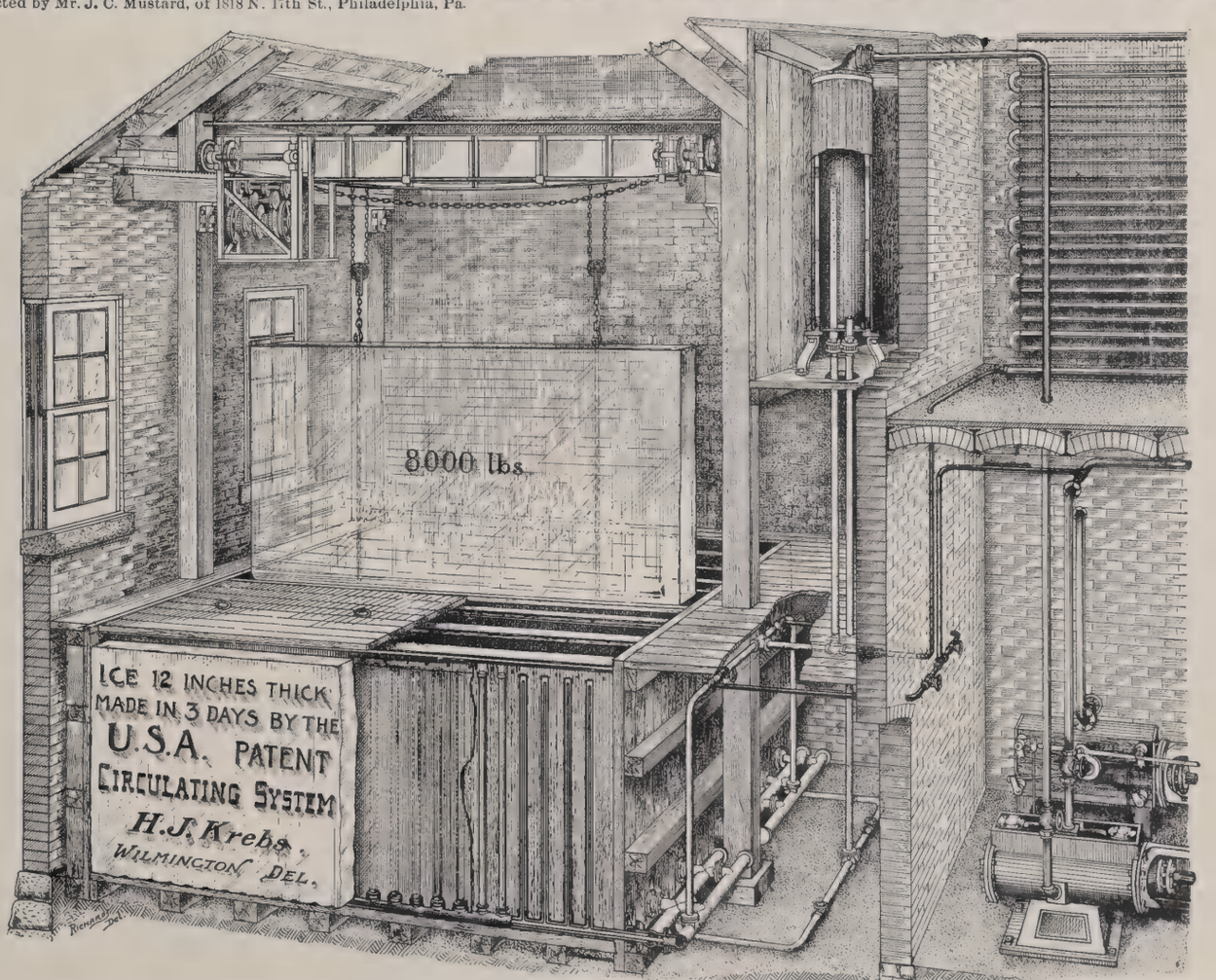
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.; Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

ROSENGARTEN & SONS,

PHILADELPHIA, PA.

Manufacturing Chemists

26° AQUA AMMONIA

FOR REFRIGERATING PURPOSES

MADE FROM SULPHATE OF AMMONIA ONLY.

PURE CRYSTAL ICE—NO CONE.

NO CANS
NO BRINE
NO PLATES
NO DISTILLING

New methods used. **Cost Reduced.** Direct Expansion System. Rapid Freezing. Harvested in Blocks of Standard Sizes by the **Steam Ice Cutter.** Can Plants changed to this system.

ADDRESS,

LEA PUSEY.
WILMINGTON, DEL.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.

I. D. FLETCHER

ANHYDROUS AQUA SULPHATE

..AMMONIA..

GUARANTEED PUREST AND BEST

PALISADE CHEMICAL WORKS

USED BY SOME OF THE LARGEST REFRIGERATING PLANTS IN THE SOUTH WITH UNVARYING SATISFACTION.

P. O. BOX 339..... 74 Baronne Street, NEW ORLEANS, LA.

Salt for Brine FOR Ice Making & Refrigerating Machines

99½ per cent PURE SALT

If a brine is made from a salt containing lime, the lime is dissolved with the salt and held in solution by the brine; but when this brine is chilled to a low temperature, it will no longer hold the lime in solution, and it will be deposited and forms a coating of insulating substance on the inside of the pipes. This can be readily seen by examining the inside of any pipe that has been used in a brine made from an evaporated salt. This coating largely decreases the amount of heat that the cold brine is capable of drawing from the surrounding medium, and reduces the effectiveness of the plant by a considerable percentage. The cost of the extra power necessary to overcome the insulation of the coating of lime would many times pay the whole cost of a pure salt.

THE RETSOF No. 1 BRINE SALT

Is 99½ per cent chloride of sodium. It is readily dissolved, and from it a brine can be made that is practically chemically pure. This salt is used by the De La Vergne, Frick, Pictet, Arctic, Mayer, Harrisburg, and other Refrigerating Machine Companies for making the brine to start their machines.

THE RETSOF SALT MINES

Are located at RETSOF, in the central part of New York State, and from this point we have every facility for shipping in any direction. From our warehouses in *New York* and *Philadelphia*, and through our agents throughout the country, we can fill orders for less than car load quantities without delay or excessive retail prices.

FOR PRICES IN ANY QUANTITY, DELIVERED AT ANY POINT, APPLY TO

FOSTER, BROWN & CO.
. . . . 146 Broadway, NEW YORK.

HELLER, HIRSH & CO.

"ABSOLUTELY PURE"

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA---

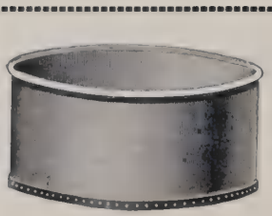
Furnished at short notice from the following offices, where we keep sufficient stocks constantly on hand:

246 North Front St. (Wm. Hoos, Ag't), *Philadelphia, Pa.*
of Walnut Street (Wm. Runkle, Agent), *Cincinnati, O.*
411 East Lombard Street, *Baltimore, Md.*
Brown's Wharf, *Charleston, S. C.*
10 Pacific Avenue, *Chicago, Ill.*

MAIN OFFICE, 164 FRONT STREET,
New York.

PURITY TEST: By WYATT & SAARBACH, Directors of National Brewers' Academy and Consulting Bureau.
99.993% ANHYDROUS AMMONIA.

Ripley Isinglass



THOMAS MITCHELL,
Tanks and Sheet Iron Work
FOR ICE FACTORIES, COLD STORAGES, BREWERIES, Etc.
Write for Estimates.
1711 to 1717 Main St., LOUISVILLE, KY.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE .·.

LIQUID ANHYDROUS AMMONIA

and **26° AQUA AMMONIA**

CONTAINING 29¼ PER CENT OF AMMONIA.

FOR REFRIGERATING PURPOSES AND THE TRADE

General Offices, 245 Broadway, NEW YORK.

WM. B. SEVERN. A. L. CAVEN.

SEVERN & CAVEN,

MANUFACTURERS OF

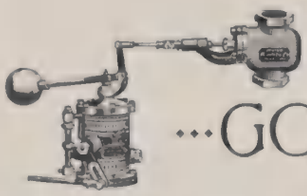
ABSOLUTELY PURE .....

Liquid Anhydrous Ammonia

MANUFACTURED FROM SULPHATE OF AMMONIA ONLY.

WORKS: WHITE HILL, N. J.

OFFICE: 48 N. Delaware Ave., PHILADELPHIA.



Steam-Pump ···GOVERNORS

By these Governors you can set your pump at any number of strokes, which will be maintained in spite of varying load or steam pressure. This Governor is used by nearly all the steam pump manufacturers in this country. We also manufacture other steam regulating devices.

MASON REGULATOR CO.
BOSTON, MASS.

ATTENTION

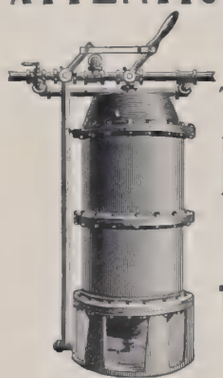
ICE MACHINE MAKERS, BREWERS AND EVERYBODY INTERESTED IN . . . .

FILTRATION OF WATER

SHOULD KNOW THAT

THE LOOMIS
Improved Water Filter

IS THE ONLY WATER FILTER WHICH CAN PERFECTLY CLEANSE ITSELF.



THE ONLY Perfect Water Filter.

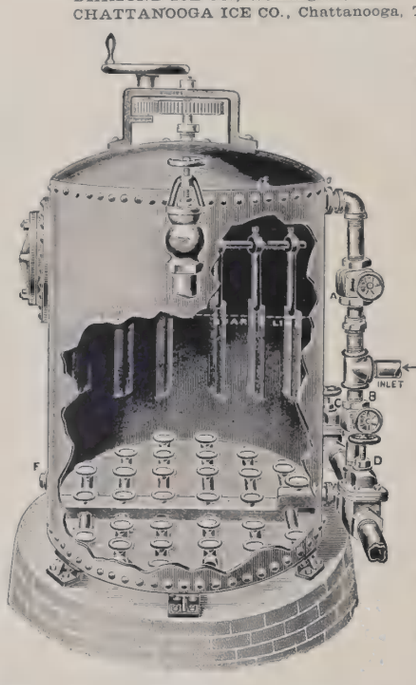
The Loomis Improved Filter Co.
43 S. Holliday Street, BALTIMORE.

New York Office, 111 Broadway, Trinity Building.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST.,
CHICAGO.

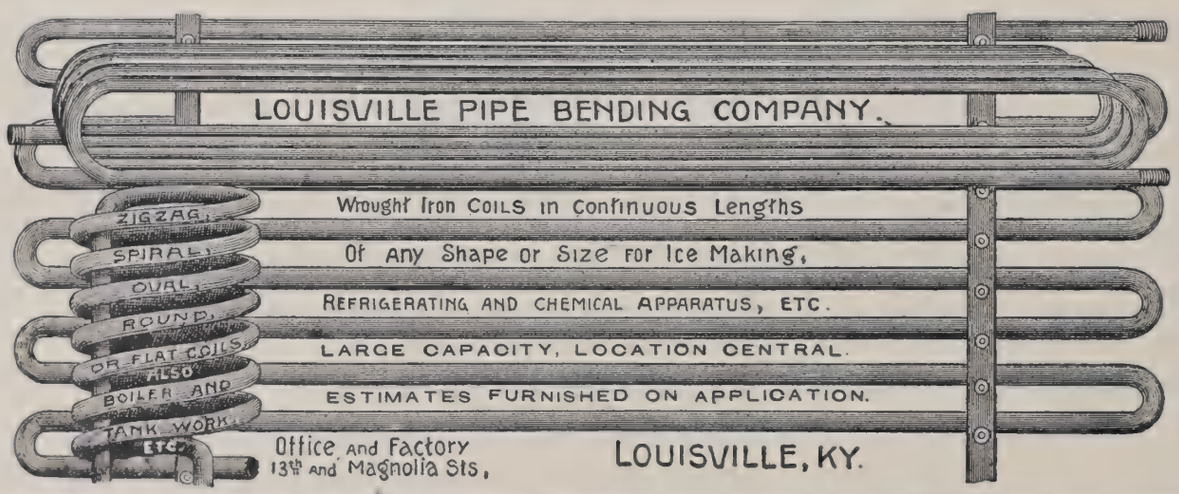
REFER BY PERMISSION TO
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.



Important
TO ICE FACTORIES.

By using our system, live steam is no longer required to make up the deficiency of exhaust steam, thus a great saving in coal, wear and tear on boilers and engines.

ABUNDANCE OF WATER WITHOUT COLOR.

We make a specialty of purifying water **WITHOUT AID OF CHEMICALS** in any form whatever.

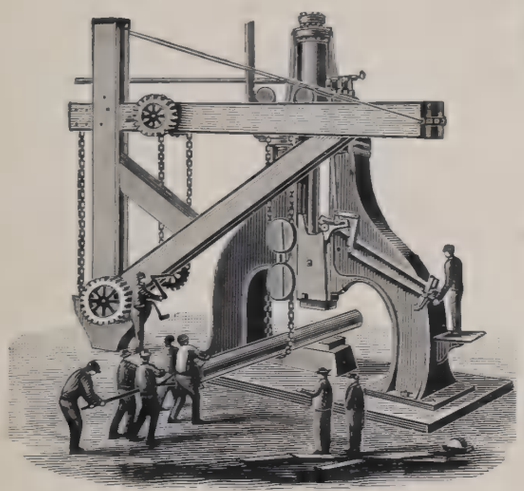


The only system that eliminates silicate, iron, bacteria, and all matter in physical solution, and is a perfect deodorizer and decolorizer. Not an improvement on any now in existence, but a distinct purifying system in itself, with no competitors.

For Particulars, References and Estimates, address

Bühring
Water Purifying Co.
1389 BROADWAY,
NEW YORK.

PIPE WELDING BY ELECTRICITY



THE SAMSON STEAM FORGE Co

OFFICE AND WORKS, CORNER Sacramento and Carroll Aves.,

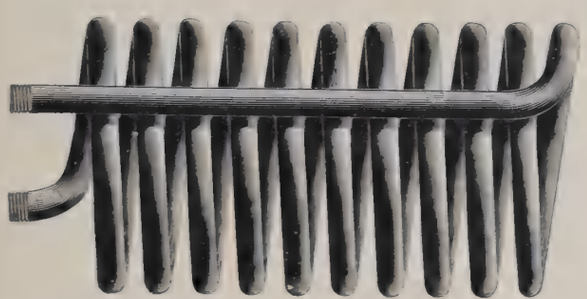
MANUFACTURERS OF CHICAGO.

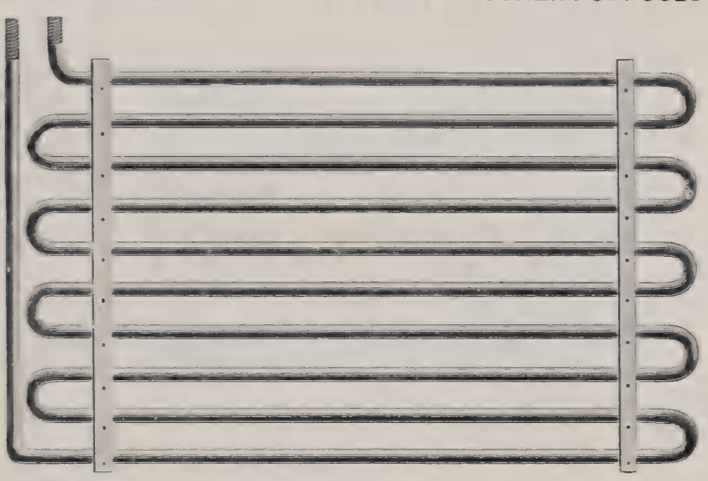
WROUGHT IRON COILS

FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES

These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.





READING IRON COMPANY

MANUFACTURERS OF

WROUGHT IRON PIPE, CHARCOAL IRON BOILER TUBES,
AND OIL WELL TUBING AND CASING . . . . . .

SPECIAL **Coiling and Ammonia Pipe**

FOR **Ice AND Refrigerating Machines**



Our Standard and Extra Heavy Pipe for bending and coiling purposes is being used largely by builders of Ice and Refrigerating Machines with unvarying success. We are also equipped for making Coils and Bends, Ammonia Valves and Fittings, Boilers, Tanks, Still and Absorbers.

Having had a large experience as builders of various types of Refrigerating Machinery, we are prepared to successfully construct this class of work.

WE ARE NOW MANUFACTURING AMMONIA FITTINGS AND VALVES UP TO AND INCLUDING 6-INCH.

WE ALSO MAKE

IRON AND STEEL FORGINGS OF ALL DESCRIPTIONS.

W. T. HILDRUP, Jr., M. E., Sec'y & Treas J. HERVEY PATTON, Chairman. D. E. TRACY, M. E., Sup't.

THE HARRISBURG PIPE BENDING CO. LIMITED.



OFFICE, N. E. COR. HERR ST. AND PENNSYLVANIA R. R.

HARRISBURG, PA.

P. O. BOX 603.

MANUFACTURERS OF

COILS AND BENDS

Of Wrought Iron Pipe

IN ROUND, OVAL, ZIG-ZAG, SPIRAL, HELICAL, AND TAPERING FORMS,

For Ice Making and Refrigerating

COILS OF ANY REQUIRED LENGTH, AND OF LARGE SIZES OF PIPE.

Prompt Delivery Assured

IRREGULAR PIPE BENDING A SPECIALTY.



AMMONIA BOTTLE.

AMMONIA BOTTLES OR FLASKS WITH WELDED HEADS

STRAIGHT OR CONCAVE

WROUGHT IRON ANHYDROUS AMMONIA BOTTLE COCKS ANY DESIRED PATTERN.

TANK DEPARTMENT

Stills and Absorbers

FOR ABSORPTION AMMONIA ICE MACHINES . . . .

BRINE AND CONDENSER TANKS

ALL SIZES

Sectional Tanks

A SPECIALTY.

These Tanks are made in flat sections, can be erected by unskilled labor, and are perfectly tight.

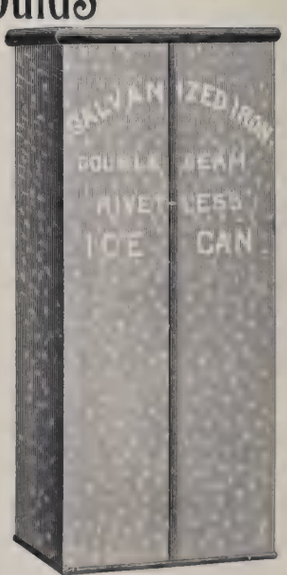
SPECIAL ATTENTION GIVEN TO REPAIRS AND REMODELING OF EXISTING ICE MACHINES.

ICE CAN DEPARTMENT

Galvanized Iron Ice Cans or Moulds

OF ANY SIZE, WEIGHT OR PATTERN.

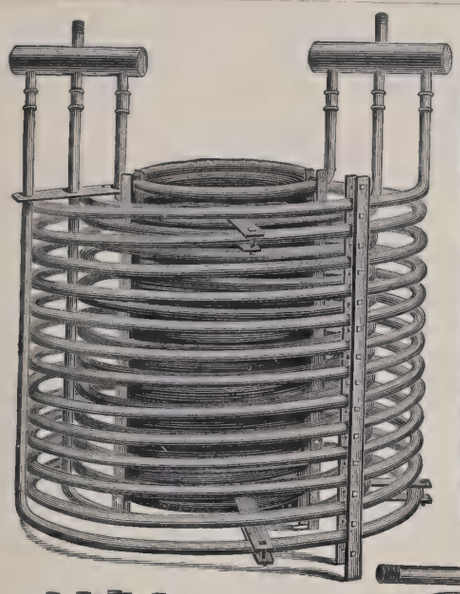
Our Double Seam, Rivetless Can has no rivets to catch the ice, which is freed from the can with less waste than any other style of Can in the market. . . . .



FLUSH BOTTOMS,
NO AIR POCKET TO FLOAT
CANS IN THE BRINE TANK.

EVERY CAN TESTED AND WARRANTED TIGHT.

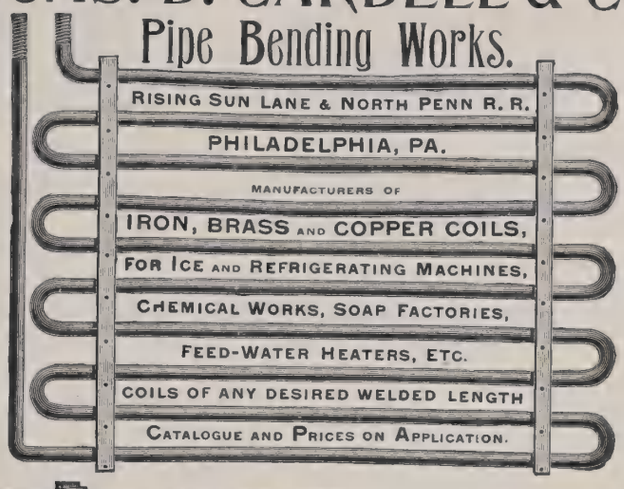
THE HARRISBURG PIPE BENDING CO. LIMITED.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

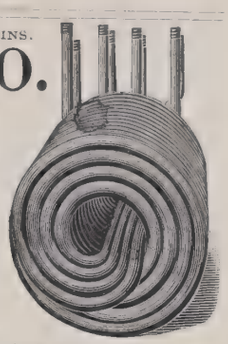
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

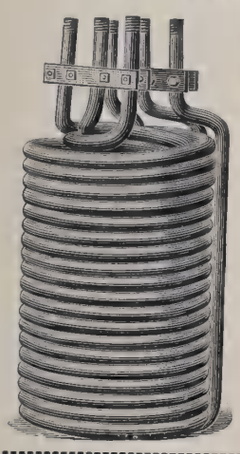
CATALOGUE AND PRICES ON APPLICATION.



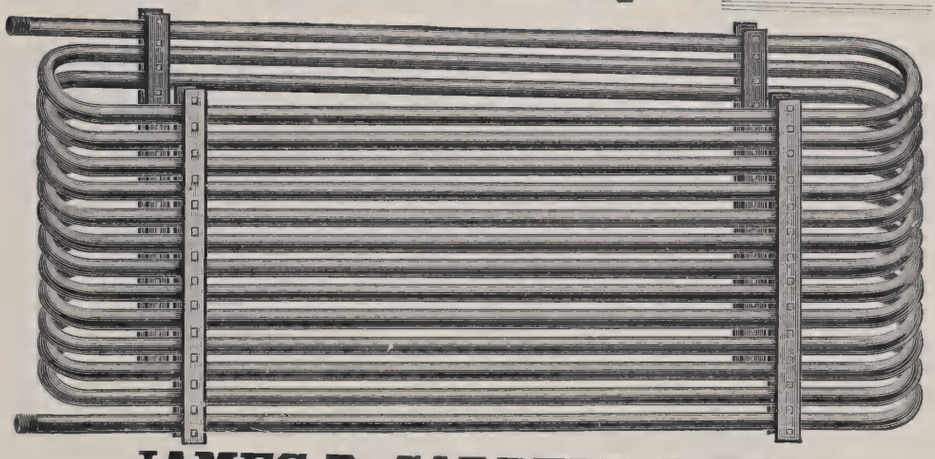
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.

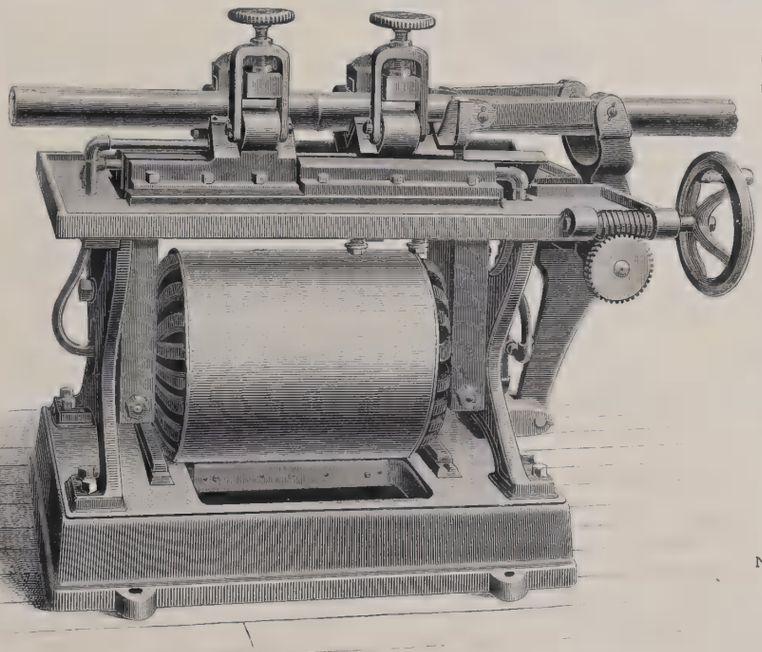


JAMES D. CARDELL & CO.

THE ELECTRIC PIPE BENDING COMPANY

OF HARRISON, N. J.

USING THE THOMSON ELECTRIC WELDING PROCESSES



Spiral Coils,
Zig-Zags,
Ovals,
Irregular
Shapes.

OF ANY SIZE AND LENGTH.

NO INJURY FROM OVER-HEATING. WELDS AND BENDS AS SOUND AS THE REST OF THE PIPE. ALL WORK PROMPTLY EXECUTED AND GUARANTEED.

***

NO BURNT OR DEFECTIVE WELDS, NO SCALE.

McCRARY'S ICE AND REFRIGERATING MACHINE

Simplicity of construction and of operation, together with low price, will win for this machine a hearing on every occasion. Capacity from one to 100 tons. Send for descriptive circular, and state capacity wanted.

MANUFACTURED SOLELY BY

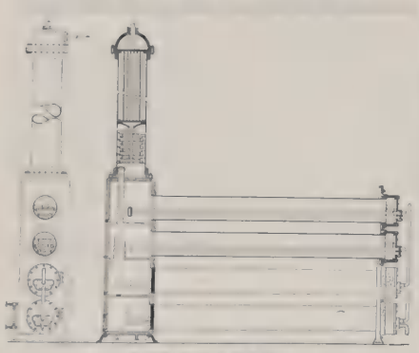
DeLOACH MILL MANUFACTURING COMPANY,

ATLANTA, GEORGIA.

Also manufacturers of the DeLOACH PATENT Saw Mill Machinery, Portable Corn Mills and Turbine Water Wheels.

SEND FOR CATALOGUE.

Ice Machines

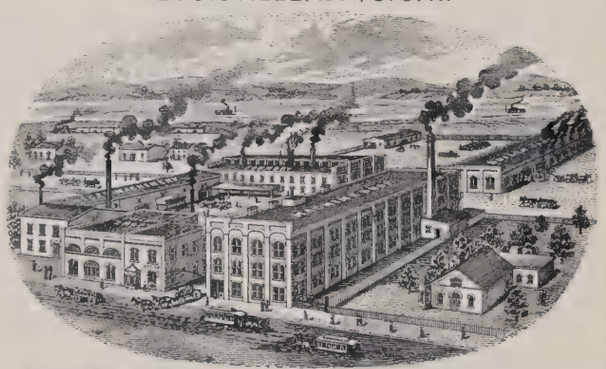


GENERATOR.

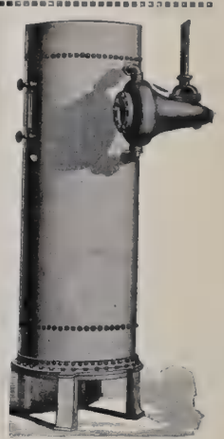
Patented Jan. 24, 1888; Sep. 23, 1890.

SULZER-VOGT MACHINE CO.

LOUISVILLE, KY., U. S. A.



IMPROVED ABSORPTION ICE MACHINES



ABSORBER, With Regulating Valve.

FARRELL & REMPE,

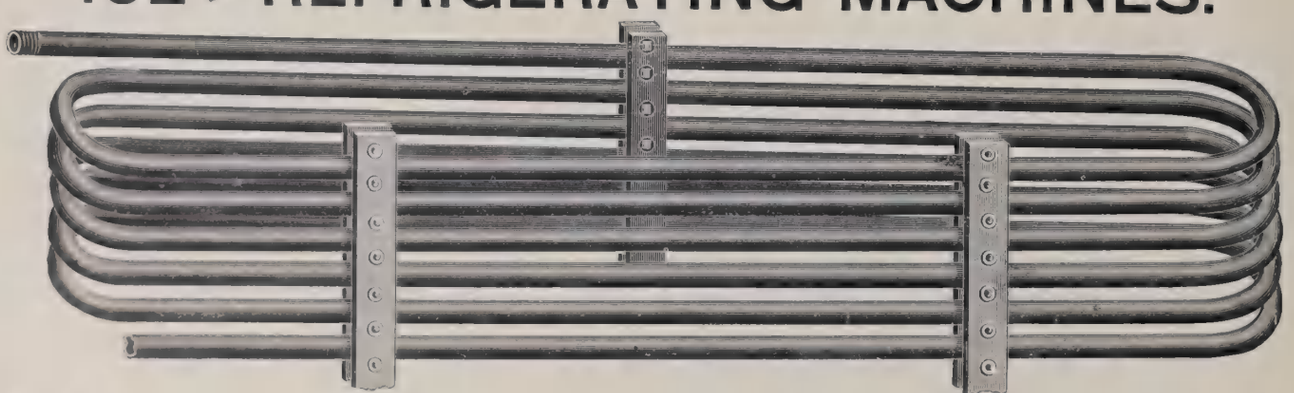
799, 801, 803 & 805 Ogden Avenue, corner Campbell Avenue, Chicago, Ill.

MANUFACTURERS OF

WROUGHT IRON COILS

—FOR—

ICE AND REFRIGERATING MACHINES.



All Ammonia Coils made of the very finest quality of Pipe (in any desired continuous length) and Tested to 400 lbs. Air Pressure.

Coils of all Descriptions for Heaters, Soap Makers, Blast Furnaces, Etc.

PIPE BENDING OF ALL KINDS A SPECIALTY.

PRICES FURNISHED ON APPLICATION.

General Eastern Agents, DIENST & LINCK, 32 & 34 Ferry Street, NEW YORK.

THE BURNS MANUFACTURING CO.

BUILDERS OF

IMPROVED ABSORPTION

Correspondence Solicited.

ICE and REFRIGERATING MACHINES . . .

FOR ICE MAKING, COLD STORAGE, PACKING HOUSES, CREAMERIES AND BREWERIES

Constructed on scientific principles, giving greatest possible results at minimum cost. Reliable, economical, easily handled and well constructed. . . . . .

OFFICE:

45 Old Capitol Building,

ATLANTA, GA.

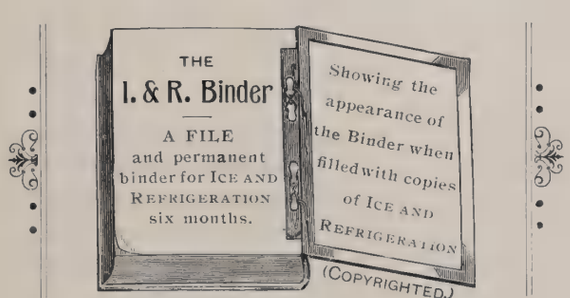
EVERY MACHINE GUARANTEED

SEE THIS SPACE NEXT ISSUE FOR ILLUSTRATION OF MACHINE.

THE

I and R BINDER

FOR 1892



Save your COPIES OF Ice and Refrigeration

FOR FUTURE REFERENCE.

EACH VOLUME IS FULLY INDEXED AND MAKES A VALUABLE WORK OF REFERENCE.

Binders holding six copies (one volume), $1.00 each, post-paid.

ADDRESS **H. S. RICH & CO.,** PUBLISHERS,
177 La Salle Street, CHICAGO.

Pennsylvania Iron Works Company

50th STREET AND MERION AVENUE,

PHILADELPHIA, PA.

BUILDERS OF

Ice Making and . . . Refrigeration Plants

Philadelphia, Dec. 29, 1891.

WE beg to announce to the public that we have concluded the purchase, from the estate of the late David Boyle, of Chicago, of the entire ICE MAKING business lately conducted by him. Being placed in possession of all drawings, patterns, etc., conversant with this line of business, and operating a large and completely equipped plant, we are prepared to execute promptly all orders for repairs, make any extensions or additions to the plants already erected, as well as to furnish estimates and plans to those contemplating the purchase of an Ice Making or Refrigerating Plant of any size.

Trusting that we may have the pleasure of being of service to you, and soliciting your commands, we are,

Very truly yours,

PENNSYLVANIA IRON WORKS CO.

New York Offices, 9 & 11 Wall St.

Prompt Shipments

GALVANIZED SHEETS

Superior Quality

MANUFACTURERS OF REFRIGERATING APPARATUS SHOULD CORRESPOND WITH US . . . . .

WE ARE UNUSUALLY WELL PREPARED TO FILL YOUR REQUIREMENTS . . . . . .

BOX 397.

THE CINCINNATI CORRUGATING CO.

PIQUA, OHIO, U. S. A.

H. H. PHILPER,

BUILDER OF

REFRIGERATING AND ICE MACHINERY

2620 S. Thirteenth Street,

ST. LOUIS, MO.

THE STAR VENTILATOR

MADE OF GALVANIZED IRON, COPPER OR BRASS

Write for Prices and Discounts.



For ventilating Mills, Factories, Foundries, Breweries; also Churches, School Houses, Theatres, in fact *all kinds* of buildings, there is *none equal to the "STAR."* *A cheap* Ventilator, which will not do the work required, is *costly at any price.* Our claim for *superiority* of the *"STAR" VENTILATOR* is based on *merit* only; we believe the *first cost* to be a *secondary consideration.*

GALVANIZED SHEET IRON Patent Leveled. Guaranteed Free from Buckles.

CORRUGATED IRON For Siding or Roofing. Galvanized and Painted. . .

MERCHANT & Co. PHILADELPHIA. NEW YORK. CHICAGO. KANSAS CITY. LONDON.

LANSING IRON AND ENGINE WORKS

Lansing, Mich.

Correspondence .·. Solicited



[BACK VIEW TANDEM COMPOUND ENGINE, MADE BY THE LANSING IRON AND ENGINE WORKS.]

MANUFACTURERS OF

COMPOUND CONDENSING AUTOMATIC

ENGINES

Boiler, Sheet Iron and Tank Work for Ice Factories and Cold Storage Plants a Specialty . . . . . .

Pennsylvania Iron Works Company,

GENERAL OFFICES AND WORKS, 50th ST. AND MERION AVE.,

PHILADELPHIA.

NEW YORK OFFICES,
9 & 11 WALL ST.

ICE MAKING AND REFRIGERATION MACHINERY

COMPRESSION OR ABSORPTION SYSTEMS.

BUILDERS OF THE CELEBRATED "BOYLE" COMPRESSION MACHINES

FROM ONE TO ONE HUNDRED TONS CAPACITY, SINGLE MACHINES.

BUILDERS OF THE.....

Rankin Absorption Machines

OF ANY CAPACITY.

EVERY MACHINE ERECTED OF BOTH SYSTEMS HAS GIVEN ENTIRE SATISFACTION IN ALL RESPECTS.

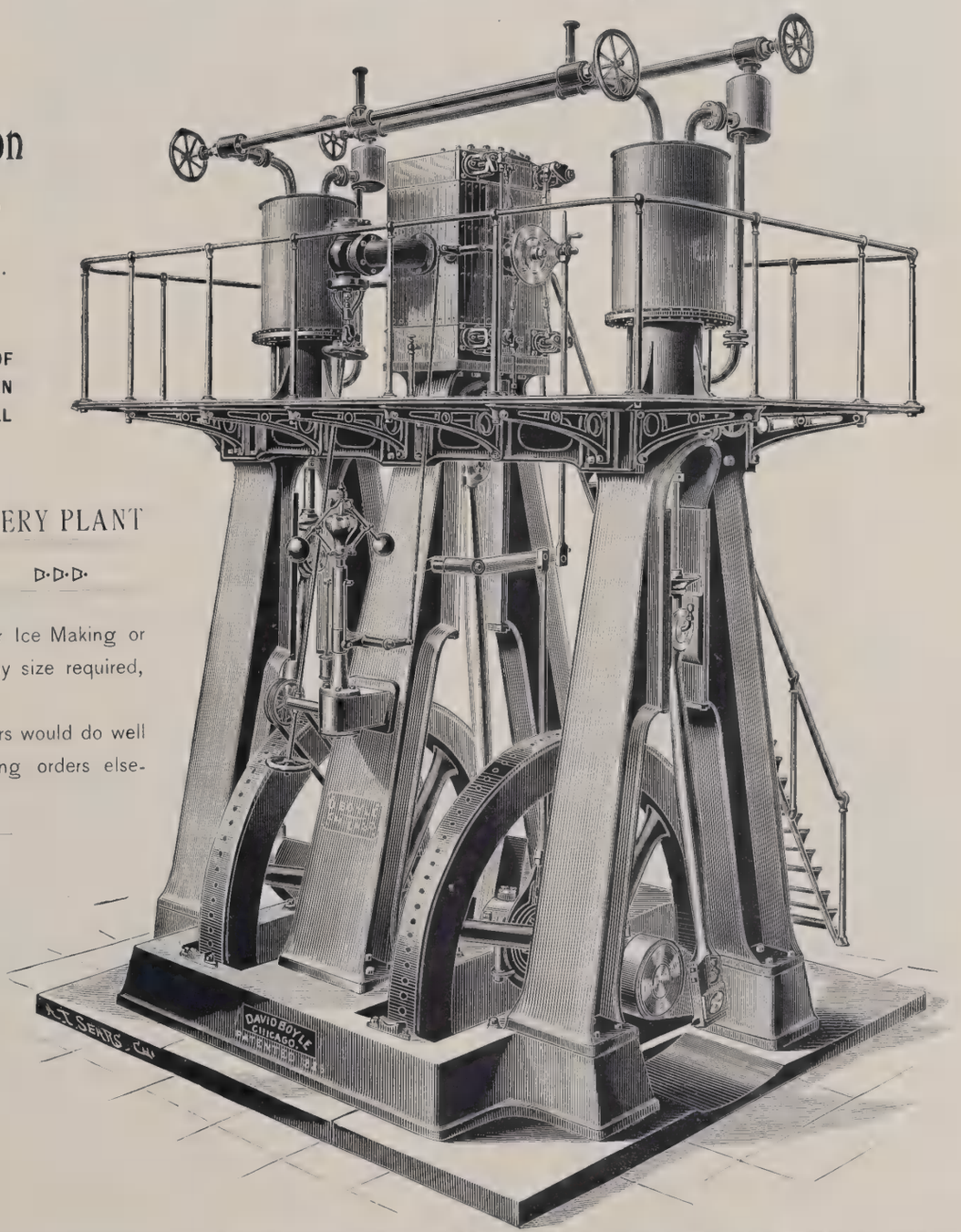
WE GUARANTEE EVERY PLANT THAT WE ERECT.

Plans and Estimates for Ice Making or Refrigeration Plants, of any size required, furnished on application.

Contemplating purchasers would do well to consult us before placing orders elsewhere.

CATALOGUES AND REFERENCES

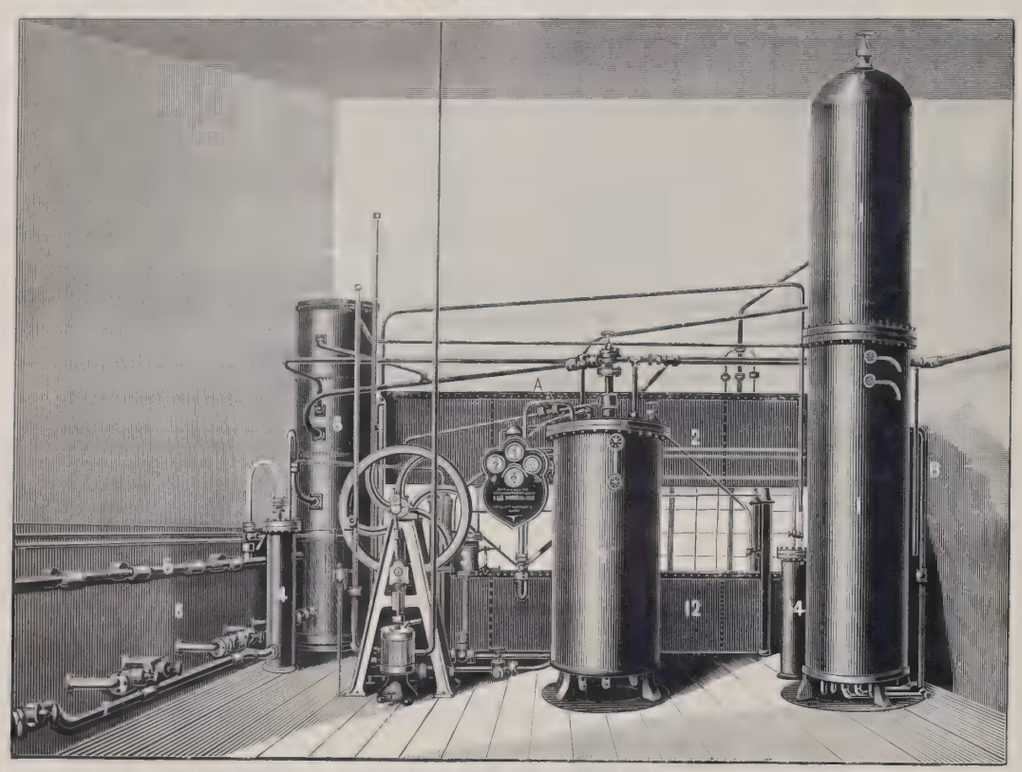
CAN BE HAD ON REQUEST FOR SAME



THE ABOVE CUT REPRESENTS THE IMPROVED "BOYLE" MACHINE FOR 50 TONS DUTY.

COLUMBUS IRON WORKS — Absorption Ice Machine

IMPROVED



SUCCESSORS TO
H. D. STRATTON & CO

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

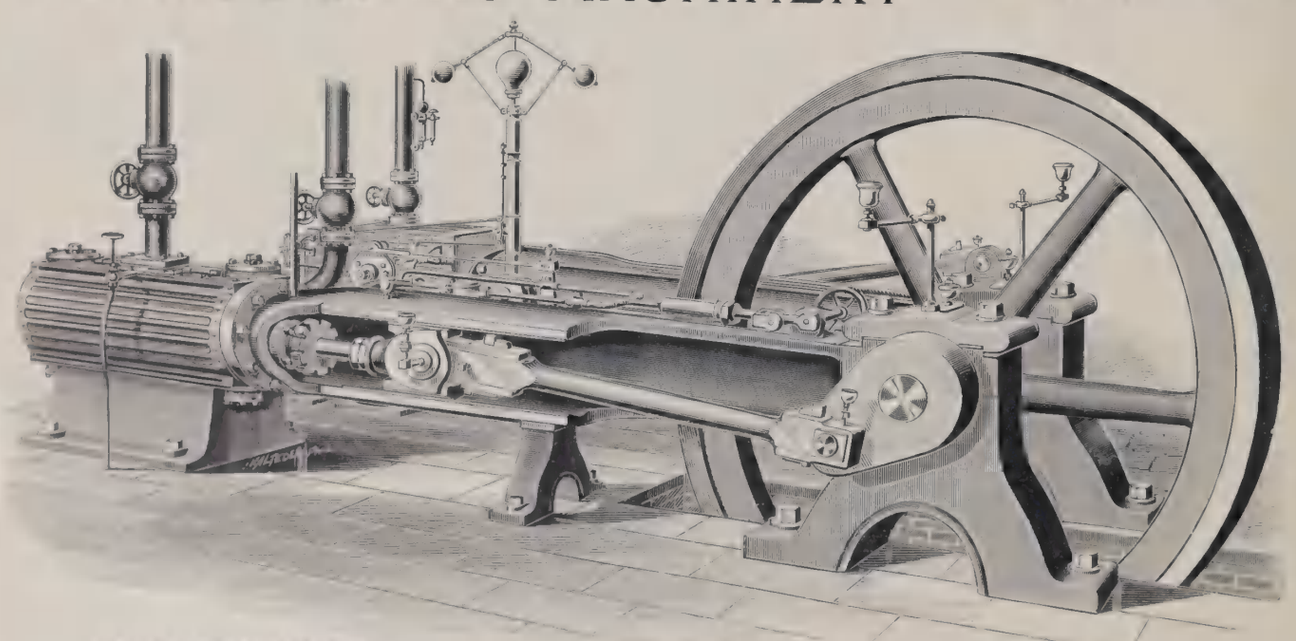
BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

REMINGTON MACHINE COMPANY

BUILDERS OF

ICE · MAKING AND REFRIGERATING · MACHINERY

Wilmington, Delaware.



HORIZONTAL COMPRESSORS,
WITH CORLISS AND SLIDE VALVE ENGINES,
HIGH PRESSURE AND COMPOUND.
From 10 to 50 Tons Capacity.

VERTICAL COMPRESSORS,
SINGLE AND DUPLEX,
DIRECT CONNECTED AND BELT POWER.
From 1 to 6 Tons Capacity.

SPECIAL AMMONIA VALVES AND FITTINGS, WROUGHT IRON TANK WORK.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS,

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

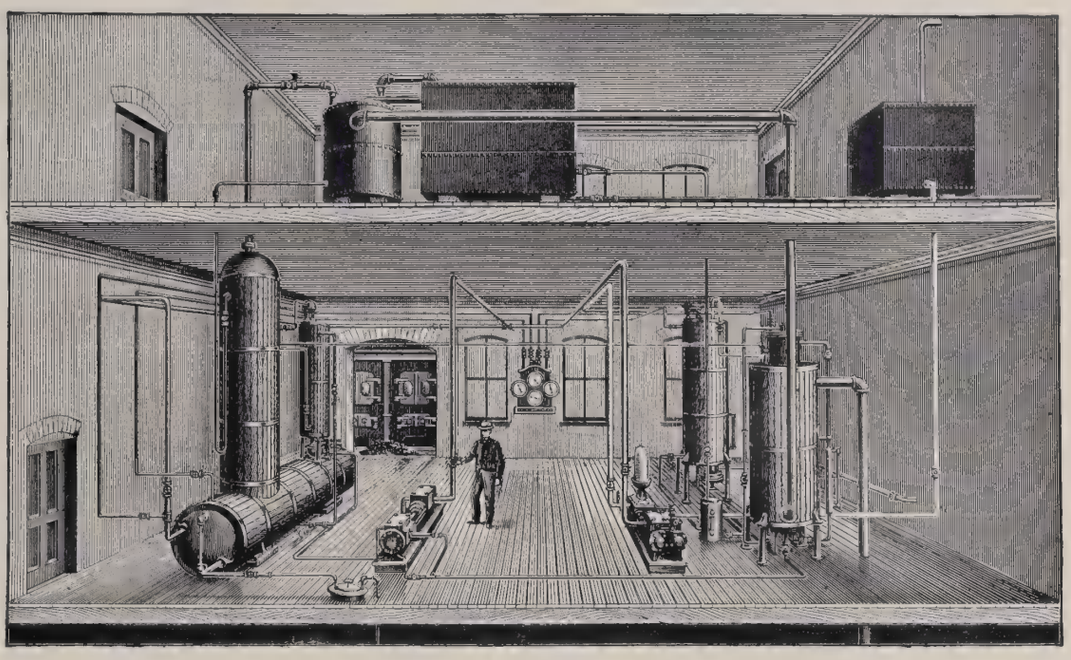
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



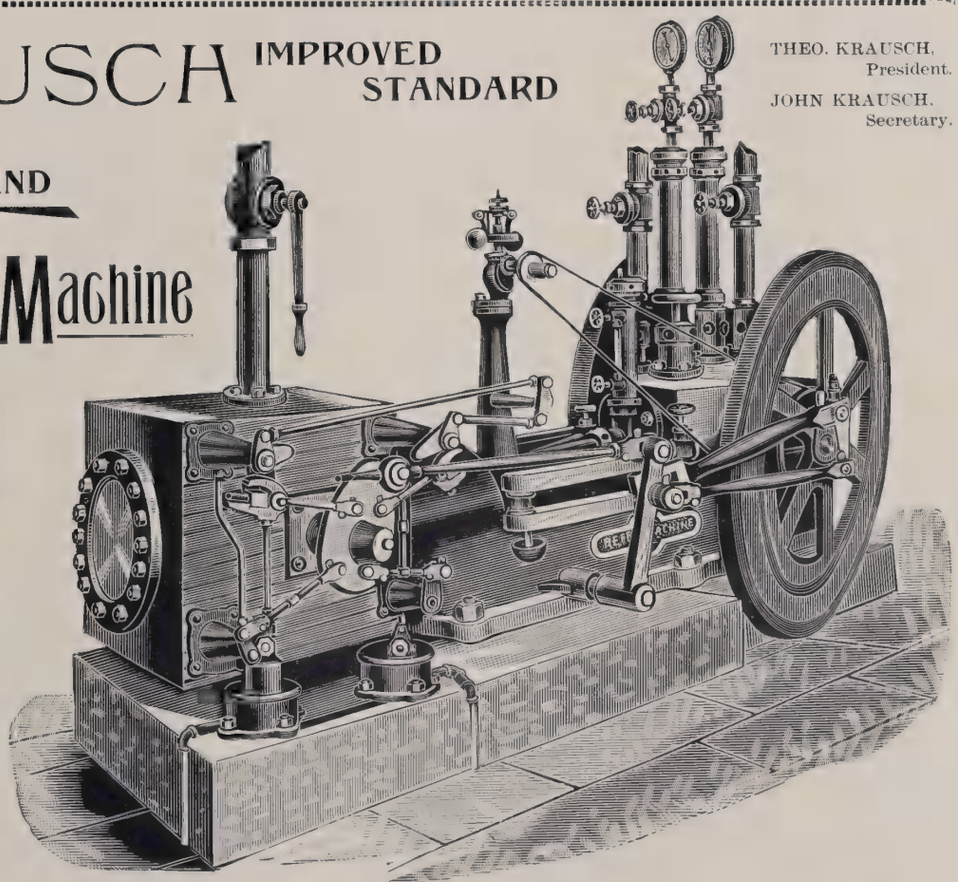
ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK 46 BRIDGE STREET, NEWARK, N J.

THE KRAUSCH IMPROVED STANDARD ICE AND Refrigeration Machine

THEO. KRAUSCH,
President.
JOHN KRAUSCH,
Secretary.



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops, Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part o Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK.

OR

THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF

INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

HAVING THE MOST RECENT AND DESIRABLE IMPROVEMENTS.

This machine has command of the absorption of the return gas from ice making tank to the ***fullest extent.*** The temperature of the absorber may fluctuate between 50 and 110 deg. Fahr. without affecting the freezing operations. We depend upon ***SURFACE IN THE ABSORBER.*** None others have it. 6,000 square feet of surfaces to which the gas has access on both sides. Should an increased output of ice be wanted in hot weather, an increase of heat through the retort will produce more ammonia gas. More pressure will condense it faster with the same water. A slight increase of the gas into the expansion coils makes ***more ice.*** More gas is readily taken up by our absorber in a given time. ***Absolute command*** of its speed of absorption. A large portion of the liberated heat due to the absorption is returned to the retort, ***thus saving fuel.*** No leaky tubes possible; none used. Objections ***heretofore held*** against ordinary absorption machines, ***does not hold*** against this machine. It is ***radically different, DECIDEDLY SUPERIOR, more simple. High temperatures not used.*** We can use exhaust steam from Corliss engines, and make ice with the "Plate" or the "Block" systems of freezing, for which we have the agency. Not possible with other machines. 500 lbs. to 50 tons capacity. ***Quality and quantity guaranteed.*** Circulars and estimates.

THE CASE REFRIGERATING MACHINE CO.

BUILDERS OF . . . ICE AND

Refrigerating

..MACHINES..

FOR ICE MAKING AND ARTIFICIAL REFRIGERATING

Full particulars, Estimates, Illustrated Circulars containing list of machines in use, etc., forwarded upon application.

We refer to the following contracts taken by us since Oct. 1, 1891.

German American Brg. Co., Buffalo, N. Y., one 60-ton machine.

Jos. Lauber Brg. Co., Binghamton, N. Y., two 20-ton machines.

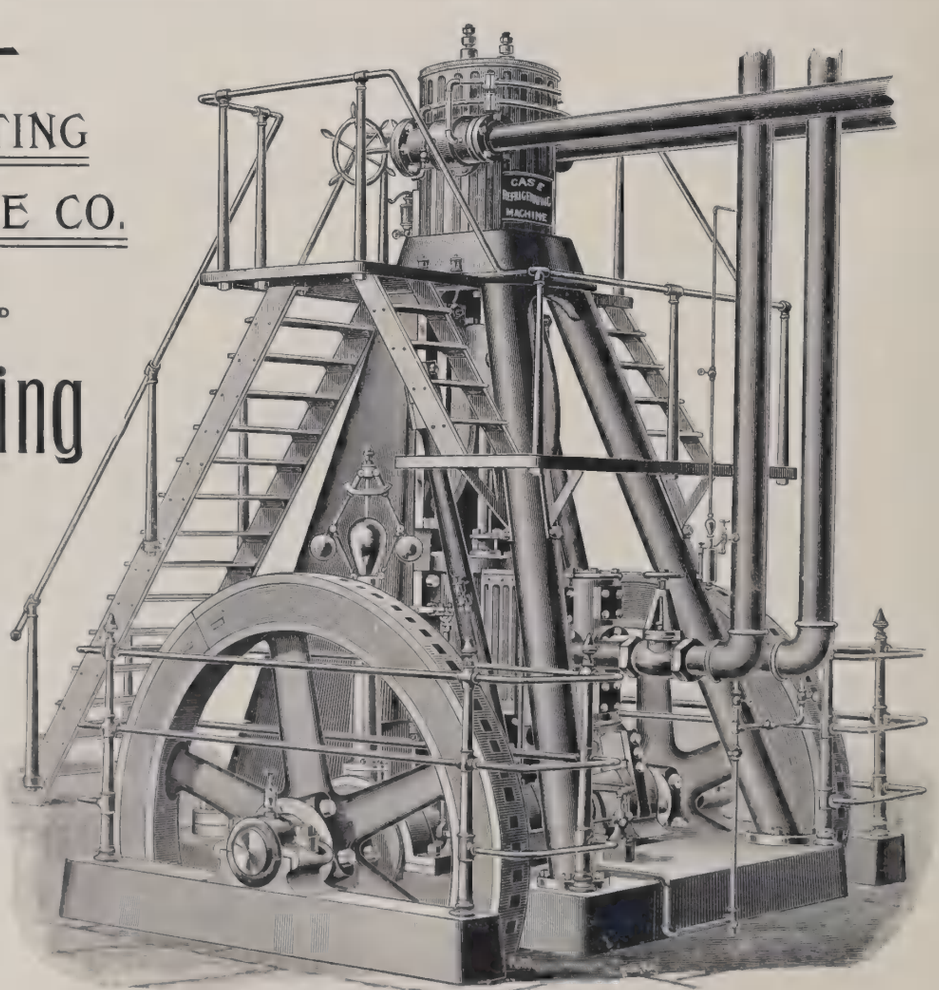
Emblem Process Oil Co., Emlenton, Pa., one 24-ton machine.

International Brg. Co., Buffalo, N. Y., one 6-ton machine.

Woodside Brg. Co., Woodside, L. I., one 20-ton machine.

Wm. Ritter, Brewer, Chicopee, Mass., one 5-ton machine.

J. Schwessler, Brg. Co., Buffalo, one 65-ton machine.



BUFFALO, N. Y.

JOHNSON,

McCARTHY

& JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

ICE & REFRIGERATING MACHINES . . . . .

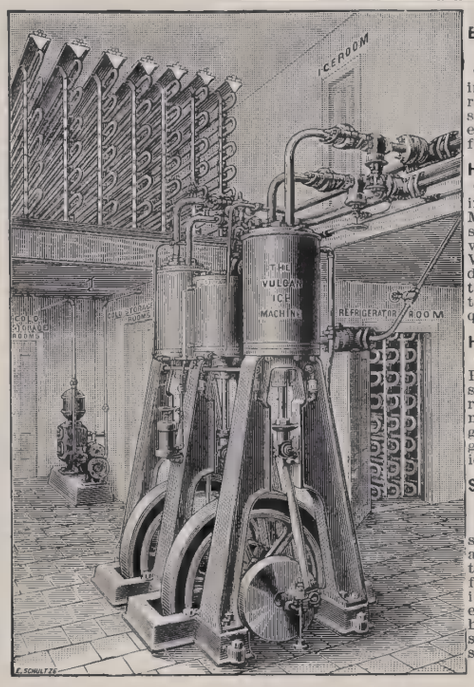
Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and . . . . .

Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect"

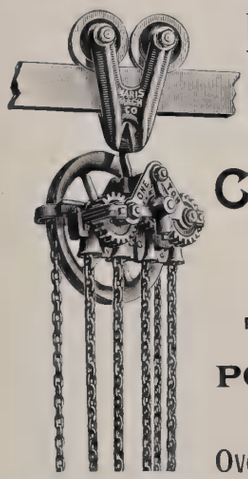
Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 188', has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

135-145 Fremont Street, SAN FRANCISCO, CAL.



MARIS MACHINE CO.

PHILADELPHIA, PA.

MANUFACTURERS OF

CRANES

POWER BRIDGE CRANES
HAND BRIDGE CRANES

FOR USE OVER FREEZING TANKS.

PORTABLE . HOISTS

Holds Load at any Point.

Overhead Track, Trolleys, Switches.

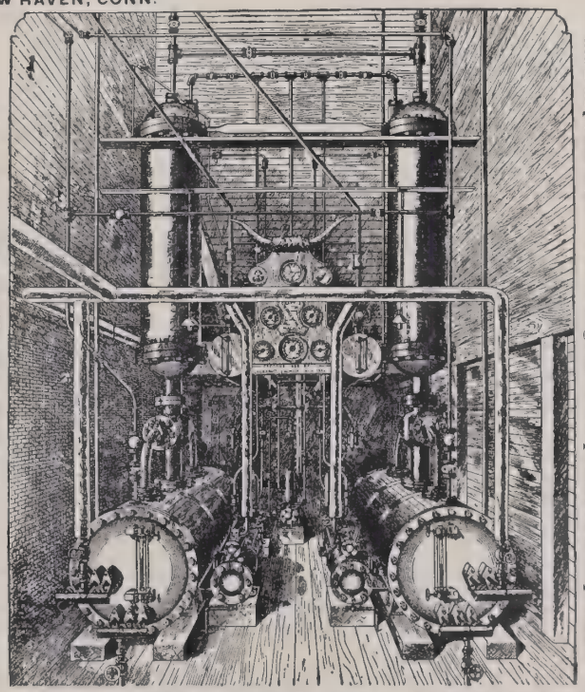
THE CRAFT REFRIGERATING MACHINE CO.

JAMES B. CRAFT, Prest.
F. L. BIGELOW, Vice-Prest.
GEORGE S. BARNUM, Sec. & Treas.

No. 15 Cortlandt Street, NEW YORK,

WORKS: NEW HAVEN, CONN.

....MANUFACTURERS OF....



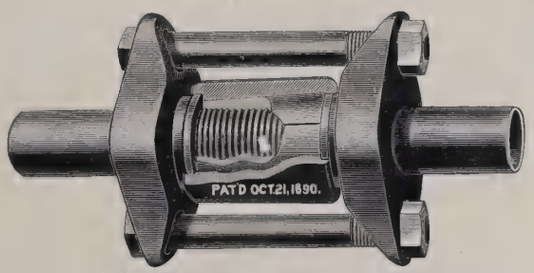
Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.

ICE AND REFRIGERATING MACHINES

FOR ICE MAKING PLANTS.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.
Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,

229 FULTON STREET, SAN FRANCISCO, CAL.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

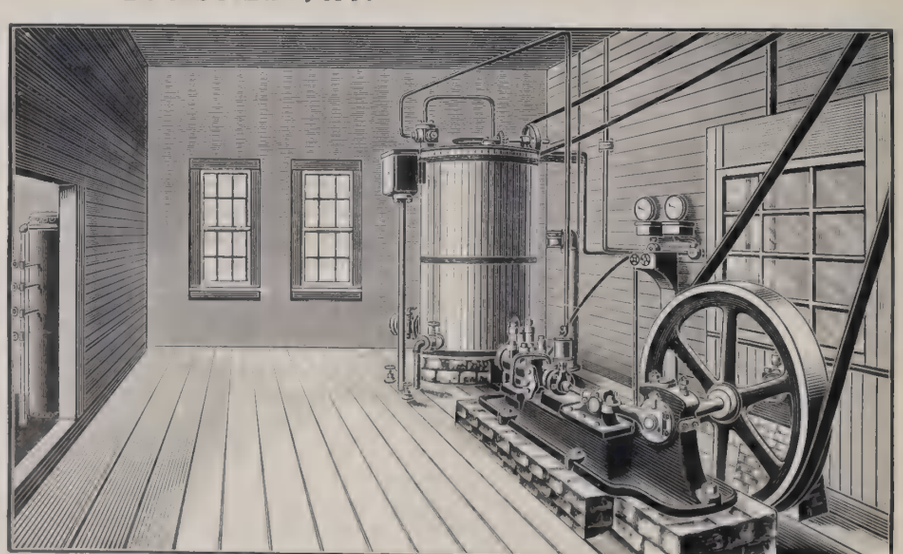
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



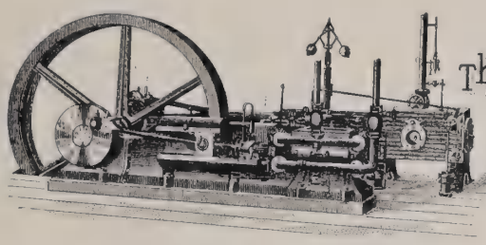
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO ... FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES,
CONFECTIONERIES,
COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING
..AUTOMATIC..
ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

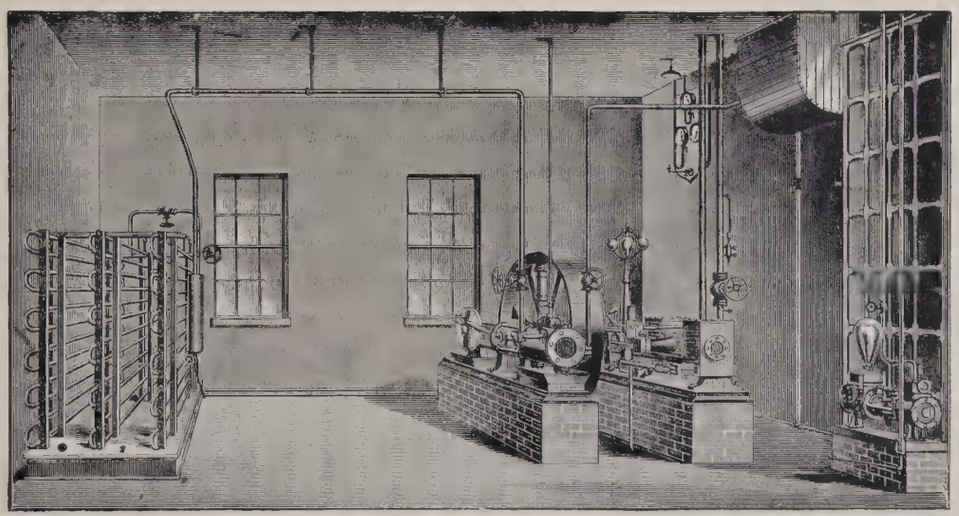
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The . American . Ice . Machine . Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND
ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability, ...
Efficiency, ...
Economy. . . . . .

ICE-MAKING OR
REFRIGERATING
PLANTS

From One Ton to Two Hundred
Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction. Every part is simple and complete,** is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

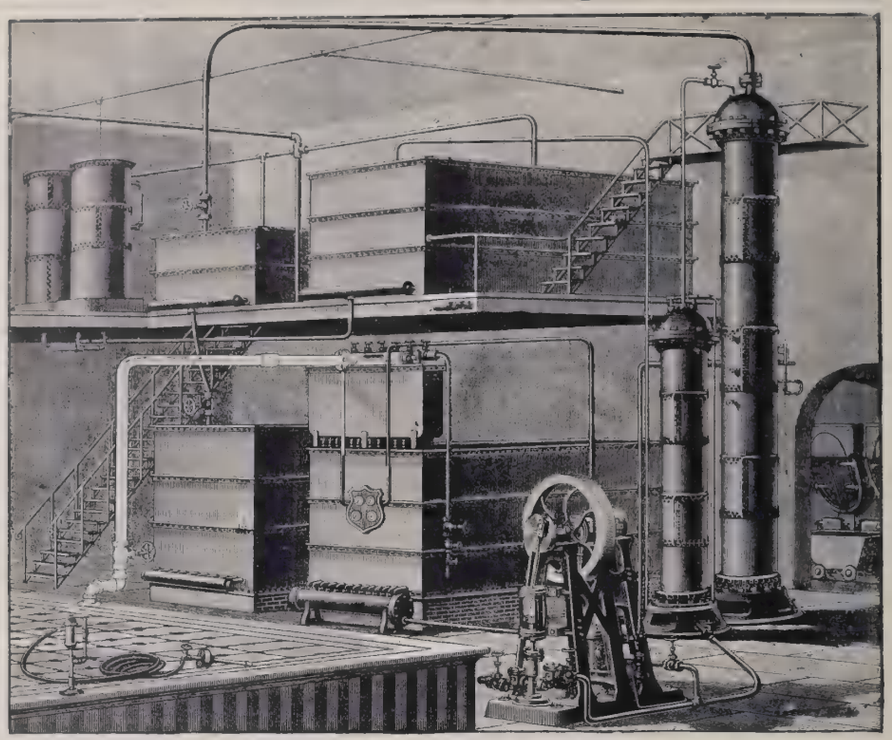
5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

Blymyer Ice Machine Company

CINCINNATI OHIO . . . . .



THE ***ABSORPTION MACHINE*** made by the Blymyer Ice Machine Co. is superior to any compression machine, either for refrigerating or ice making. These machines are ***radically different*** from all other absorption machines, and are in every way superior to them.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.		NAME.	ADDRESS.
1	8	Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10	"	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15	"	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5	"	A. Moresi	Jeanerette, La.
1	15	"	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10	"	Morris Ice Co.	Jackson, Miss.
1	15	"	Texarkana Ice Co.	Texarkana, Tex.
1	30	"	Lookout Ice & Cld. Stor. Co. (2d Order)	Chattanooga, Tenn.
1	5	"	Gadsden Ice Co.	Gadsden, Ala.
1	6	"	Sheffield Ice Co	Sheffield, Ala.
1	5	"	Decatur Ice Co	Decatur, Ala.
1	30	"	Crystal Ice Co.	Wichita, Kan.
1	3	"	Denton Ice Co	Denton, Tex.
1	5	"	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5	"	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25	"	Hutchinson Ice Mfg. Co.	Hutchinson, Kan.
1	12	"	Parkersburg Ice Co	Parkersburg, W.Va.
1	30	"	Union Ice Co.	Denver, Col.
1	3	"	Dominick & Karston	West Point, Miss.
1	3	"	DeCoppet Ice Co.	Somerset, Ky.
1	35	"	Evansv'le Ice & Cld. Stor. Co. (2d Order)	Evansville, Ind.
1	2	"	Van Horn & Chambers	Lebanon, Ohio.
1	4	"	John C. Webb	Demopolis, Ala.
1	12	"	Huntington Ice and Storage Co.	Huntington, W.Va.
1	3	"	Tupelo Ice Co	Tupelo, Miss.
1	30	"	Wheeling Ice and Storage Co	Wheeling, W.Va.
1	10	"	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
1	10	"	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1	"	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20	"	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12	"	Marietta Ice Co	Marietta, O.
*1	35	"	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30	"	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35	"	Evansv'le Ice & Cld. Stor. Co. (3d Order)	Evansville, Ind.
*1	3	"	Connolly & Curtis	Columbus, Miss.
*1	5	"	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5	"	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5	"	Grenada Cream'y, Cld. Stor. & Ice Co	Grenada, Miss.
*1	15	"	Washington Ice Co	Washington, Ind.
*1	30	"	Wheeling Ice & Storage Co. (2d Order	Wheeling, W.Va.
*1	32	"	Consumers Ice Co.	San Francisco, Cal.
*1	15	"	Shelbyville Artificial Ice Co.	Shelbyville, Ind.
*1	30	"	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.		NAME.	ADDRESS.
*1	15	Ton.	Skinner & Olson	Topeka, Kan.
*1	35	"	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35	"	Evansv'le Ice & Cd. Stor. Co. (4th Order)	Evansville, Ind.
*1	55	"	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order)	Dayton, O.
*1	15	"	Ashland Artificial Ice Co.	Ashland, Ky.
**1	8	"	Gibson House	Cincinnati, O.
**1	10	"	Palace Hotel	San Francisco, Cal.
**1	30	"	The People's Ice Co.	Birmingham, Ala.
**1	35	"	Citizens Ice Co.	Los Angeles, Cal.
**1	20	"	Civill & White	Colorado Spr'gs, Col.
**1	30	"	Pueblo D. W. Ice & Cd. S. Co. (2d Order)	Pueblo, Col.
**1	60	"	Colorado Ice and Storage Co.	Denver, Col.
**1	25	"	E. B. Cornell	Tampa, Fla.
**1	5	"	Mr. H. G. Meumann	Bessemer, Ala.
**1	20	"	Consumers Ice Co.	Vicksburg, Miss
**1	35	"	Artificial Ice and Storage Co.	Canton, O.
**1	12½	"	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30	"	Crystal Ice Co.	Albuquerque, N. M.
**1	15	"	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5	"	Dayton Ice Co.	Dayton, Tenn.
**1	15	"	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½	"	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10	"	Mr. August Erath	New Iberia, La
**1	55	"	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32	"	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15	"	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55	"	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32	"	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50	"	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12	"	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15	"	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5	"	Fleischman & Co.	Cincinnati, O.

* These machines were erected in 1890.

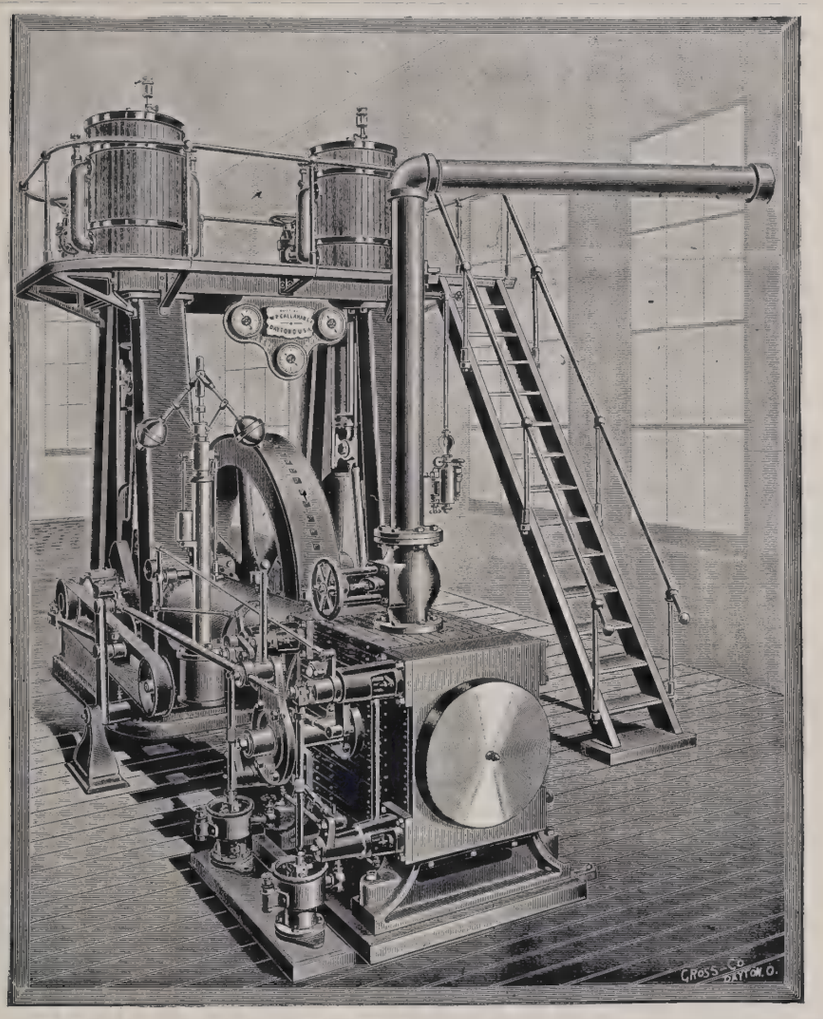
** These machines were erected in season 1891.



BLYMYER REFRIGERATING MACHINES NOW IN OPERATION.

No.	Size.		NAME.	Address.
2	50	Ton	Louisiana Brewing Co.	New Orleans.
1	40	Ton	Toledo Br'g & Malt'g Co.	Toledo.
1	40	Ton	Hudepohl & Kotte (Brew'y)	Cincinnati.
1	50	Ton	Savannah Brewing Co.	Savannah.
1	25	Ton	Schantz & Schwind (Br'y)	Dayton
1	15	Ton	John Smith's Sons (Brew'y)	Youngstown.
1	12	Ton	Christ Diehl (Brewery)	Defiance.
1	12	Ton	Genessee Oil Works.	Buffalo.
1	12	Ton	S. Davis, Jr., & Co. (Pack'rs)	Cincinnati.
1	50	Ton	Occidental Packing & Provision Co.	Lincoln.
1	15	Ton	Thos. McFadden, Jr. (Cd. St.)	Pittsburgh.
1	15	Ton	Grocers' Supply Co. (Cd. St).	Pittsburgh.
*1	40	Ton	Adolph Coors (Golden Br'y)	Golden.
*1	20	Ton	F. Conrad (Brewery)	Anaheim.
*1	25	Ton	The Sachs-Prudens Ale Co.	Dayton.

* These machines were erected in 1890.



CUT OF . . . . . .
FIFTY TON REFRIGERATING
AND . . . . . .
THIRTY TON ICE MAKING
MACHINE, BUILT BY

W. P. CALLAHAN & CO.

BUILDERS OF

Ice Making AND Refrigerating Machinery

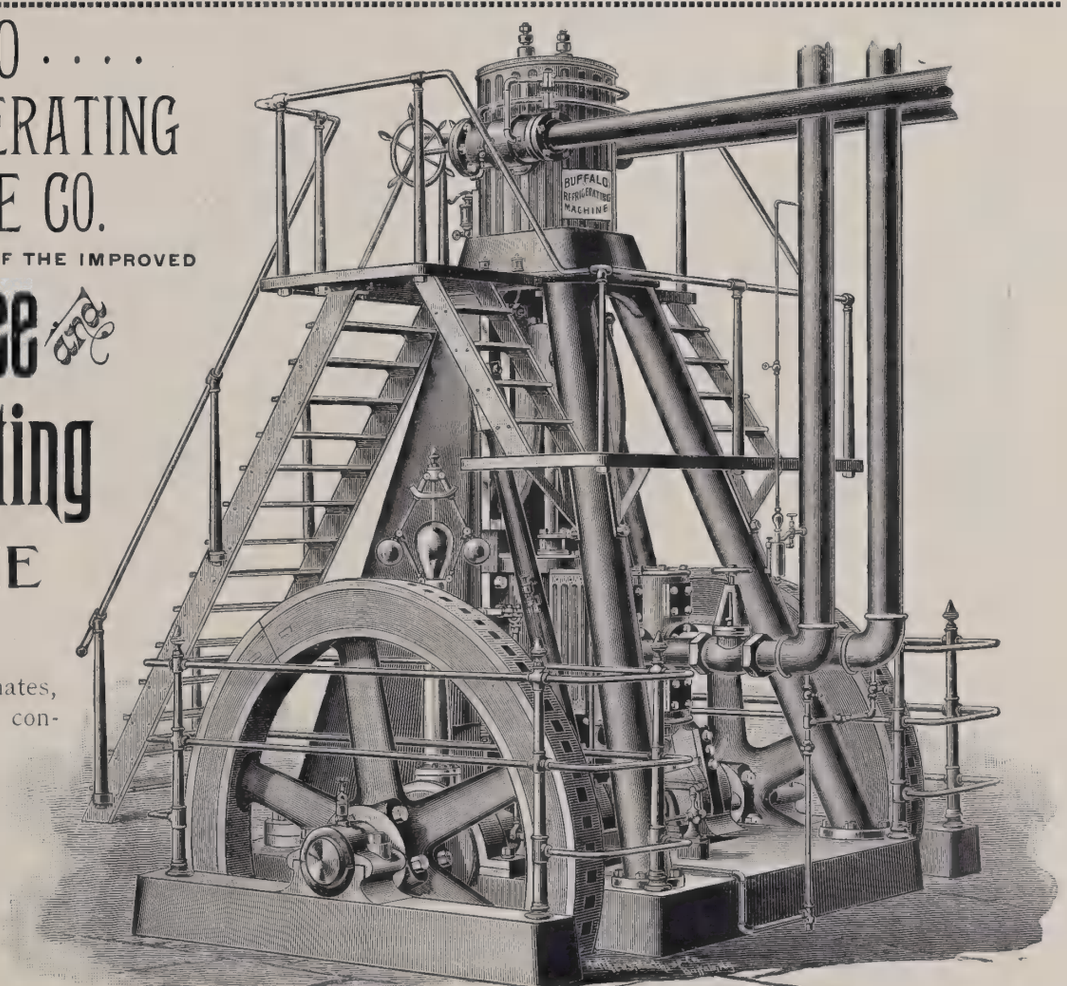
UNDER M. DENNEDY'S PATENT.

DAYTON, OHIO, U. S. A.

BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE



Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

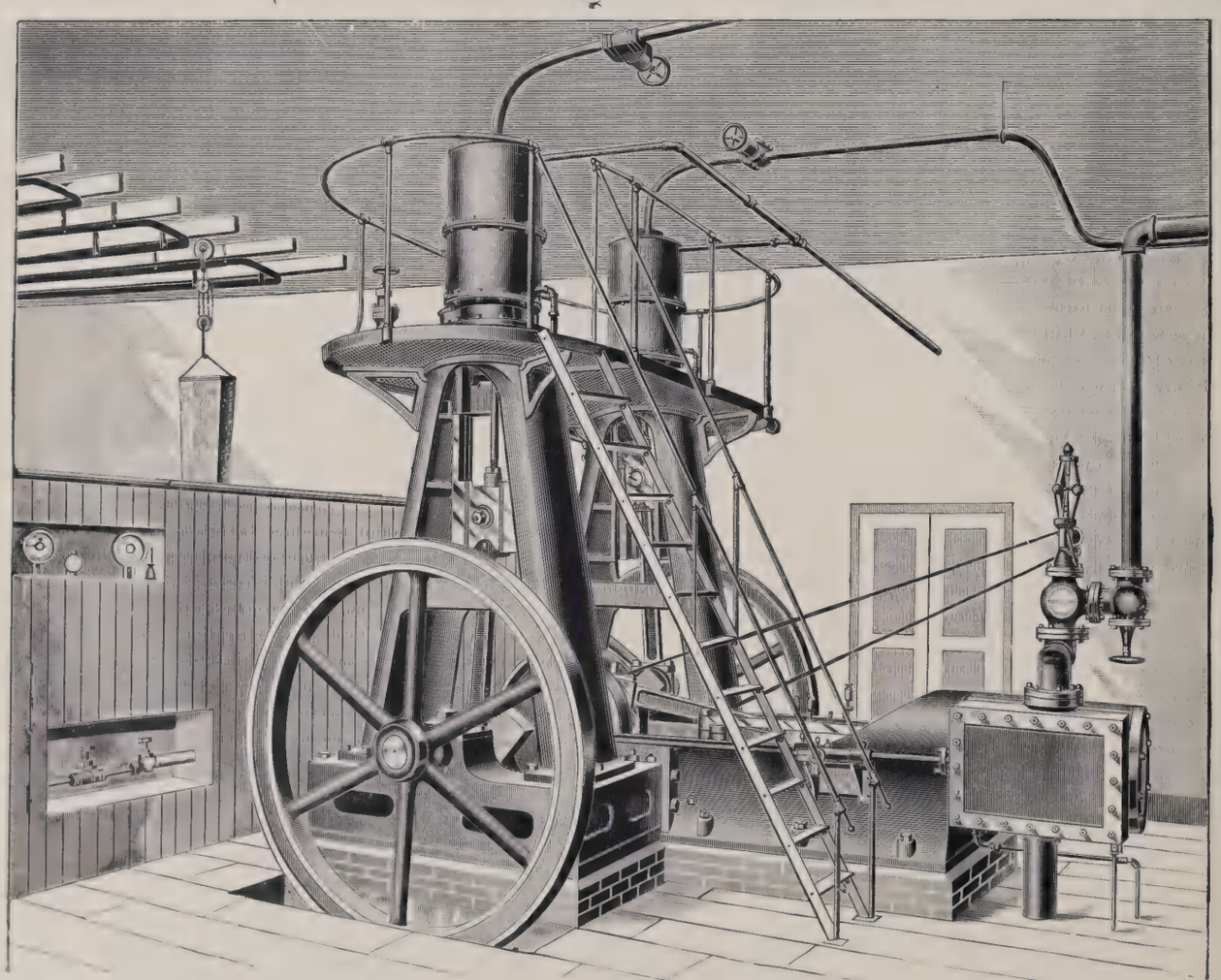
ICE MAKING MACHINERY

E. C. HILLYER & CO.

MANUFACTURERS OF

Improved Ice Making Machinery AND Refrigerating Apparatus

UNDER THE JOHNSON PATENTS.



VESSEL AND STEAMSHIP PLANTS

THE SIMPLEST AND MOST EFFECTIVE ICE MAKING MACHINERY ON THE MARKET

All working parts made to gauge and template, so as to be readily duplicated. Correspondence solicited. Testimonials from parties using our machines on application. We build our own machinery, and therefore can guarantee everything fully. Our machine will in every case make the amount of ice guaranteed. Send for our pamphlet: "HOW TO MAKE AN ICE FACTORY PAY."

WE BELIEVE OURS TO BE THE ONLY SYSTEM WHERE ALL THE APPARATUS IS ON ONE FLOOR.

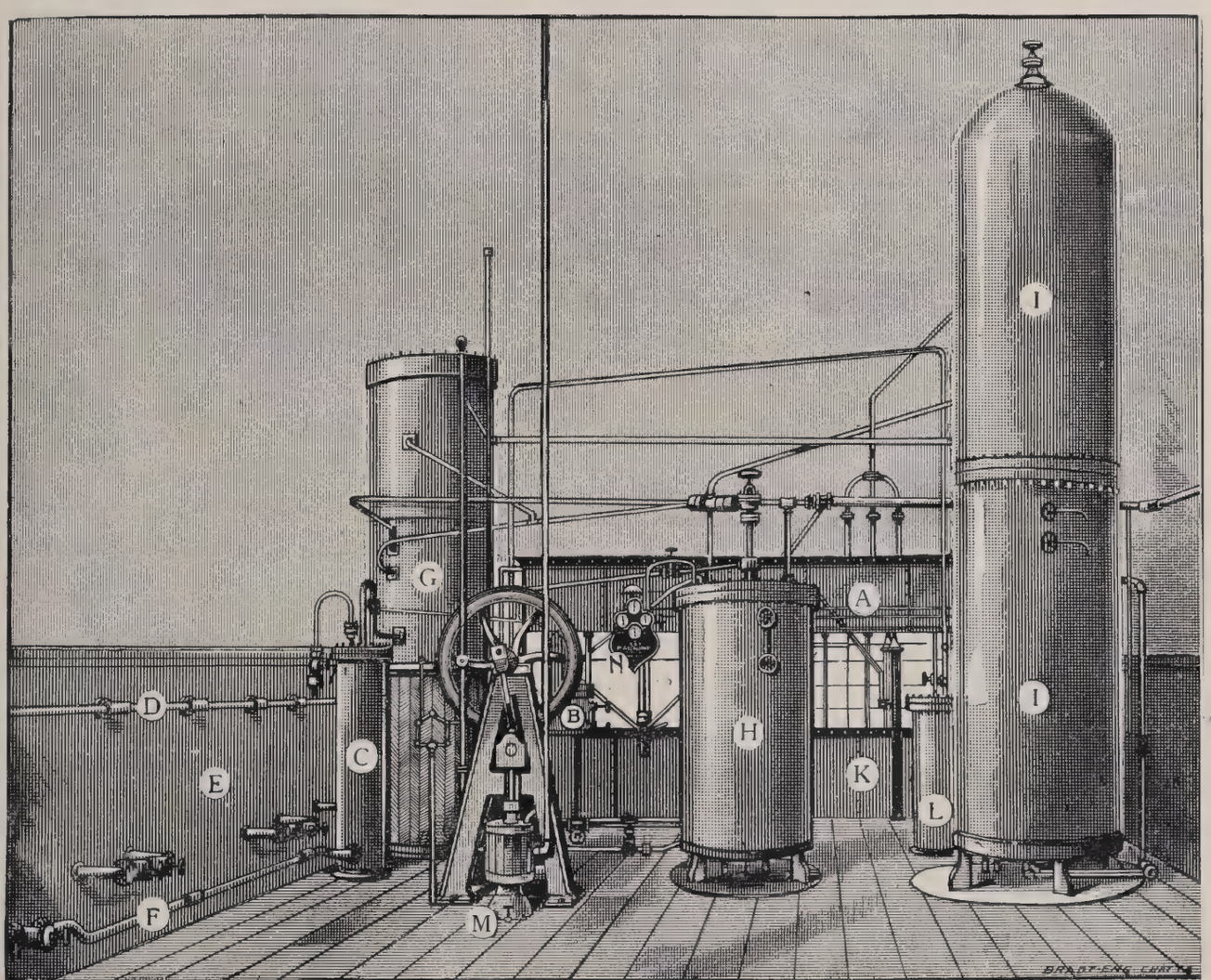
Office and Works, **NEWPORT NEWS, VA.**

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

. . . The Latest Improved Absorption . . .

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.



The "STEAM JACKET"
BOILS THE WATER.

WM. BARAGWANATH & SON,

48, 50 & 52 WEST DIVISION STREET,

CHICAGO.

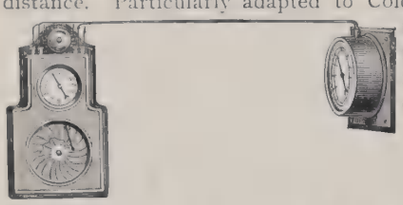
.....MANUFACTURERS OF.....

EXHAUST FEED WATER HEATERS
LIVE STEAM FEED WATER PURIFIERS
POWER PUMPS, ETC., ETC.

SEND FOR CIRCULARS.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.

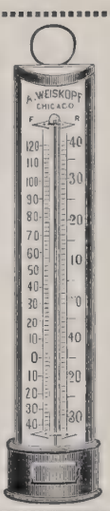


FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 13 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

.....MANUFACTURER AND IMPORTER OF.....

THERMOMETERS
AND HYDROMETERS.

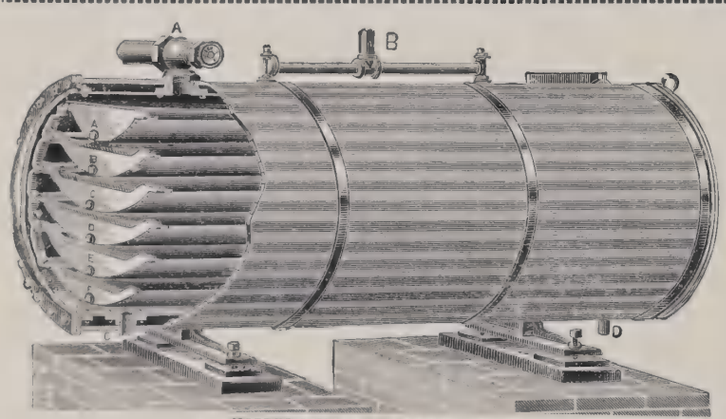
Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.





HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

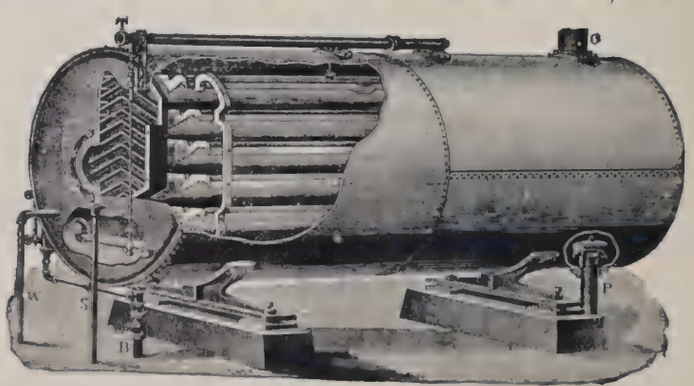
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

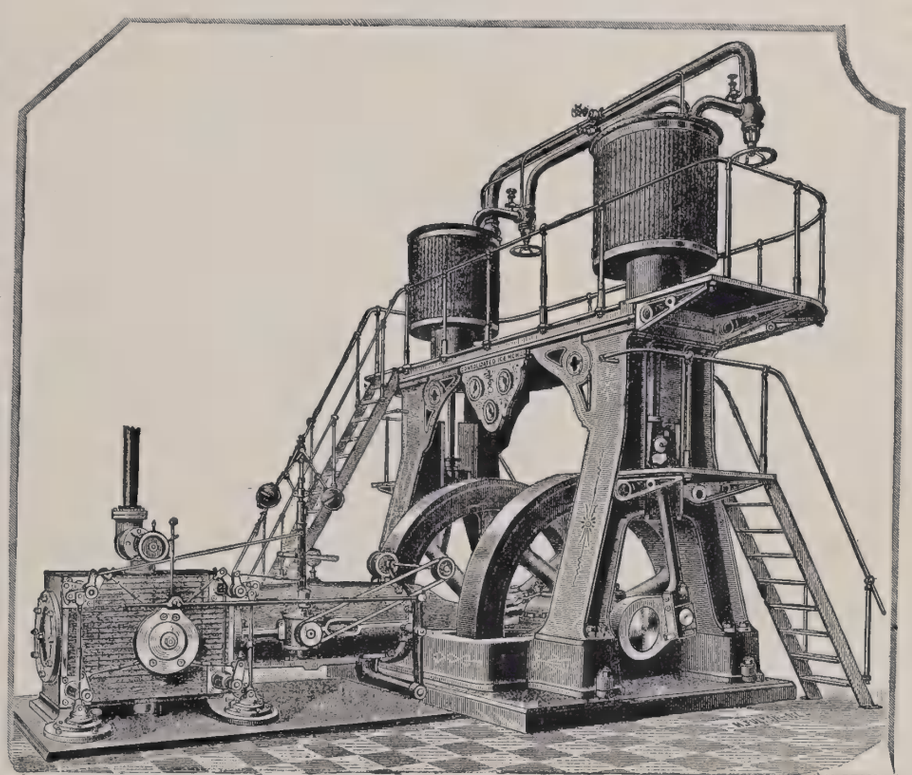
HEATER



HOPPES EXHAUST HEATER



CONSOLIDATED ICE MACHINES



FOR several years past we have been engaged in building Consolidated Ice Machines, and many of the very best running in the United States, at the present time, are of our manufacture. Since the original Company have failed, we have concluded to continue this business, and hereafter will manufacture, to order, any kind or style of a Consolidated Ice Machine desired. We will also contract for complete plants, and will put in either direct or brine circulation, as may be desired. We make a specialty of furnishing duplicate parts, and keep them always in stock, and can furnish on short orders any detail of these machines. We manufacture special steel valves and white metal rings designed especially for ammonia work.

We guarantee protection against any and all claims or pretended claims for patents on these machines.

These machines are known throughout the United States for the excellence of their construction, and their superiority to all others in use. They need no better recommendation than their own work. All the material and workmanship on them is of the finest quality. We have the original drawings and patterns in our possession, and can furnish a better machine for less money than can be built elsewhere. We also manufacture and keep on hand to supply the trade the finest steel fittings and steel valves made in the world, designed especially for ammonia work, and will be pleased to quote prices to purchasers.

NOTE.—It has come to our knowledge that parties owning or claiming to own a bogus patent, issued to one James Boyle in 1876, for an ammonia compressor, have been putting in circulation notices that the pumps used on the Consolidated Refrigerating Machines is an infringement on said patent, and that they will bring suit against any one using them; therefore we hereby guarantee to all persons purchasing one of our machines protection against said fraudulent claims, and request all persons receiving one of such notices to forward the same to us, with a statement setting forth whether they have been influenced not to buy a Consolidated Machine thereby. We also give the parties setting up these claims public notice that we will bring suit against them for damage to our business by them, by misrepresentation and fraud.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

= NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF ICE

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

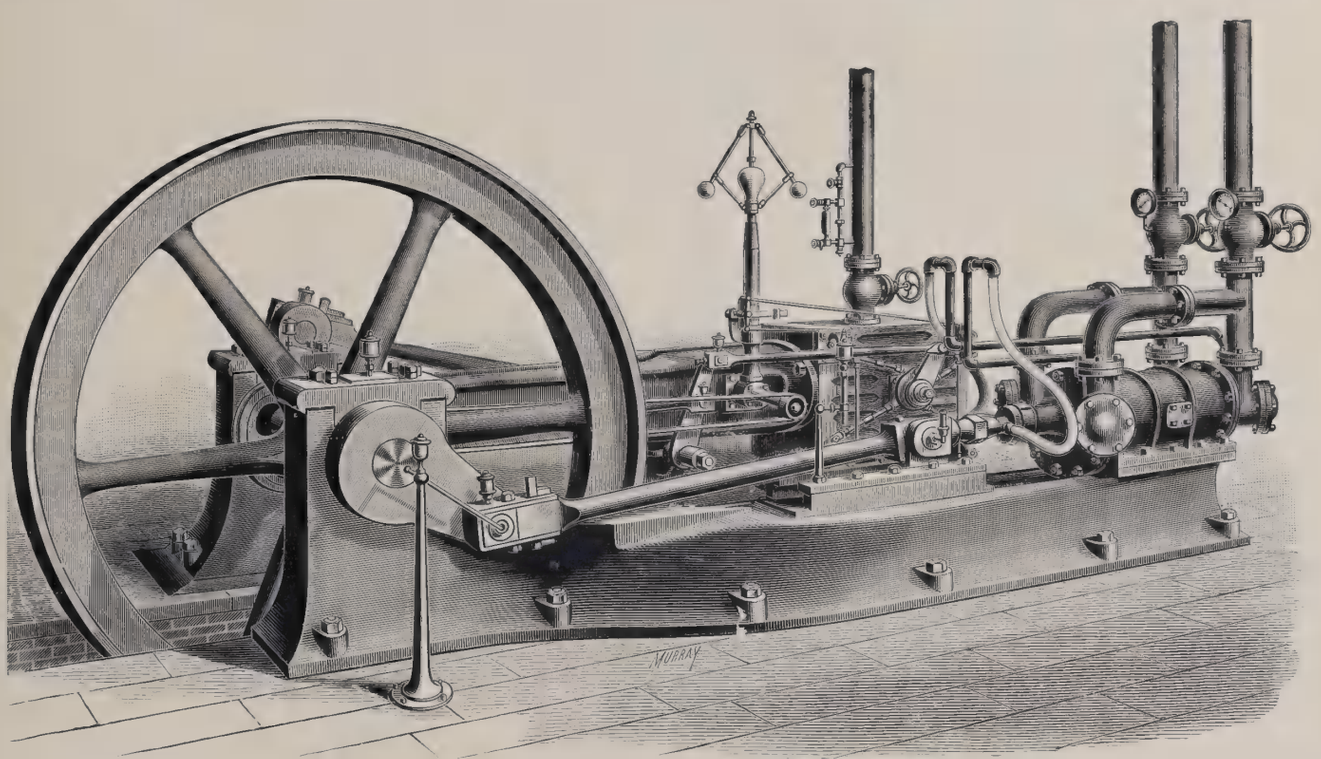
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS,
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

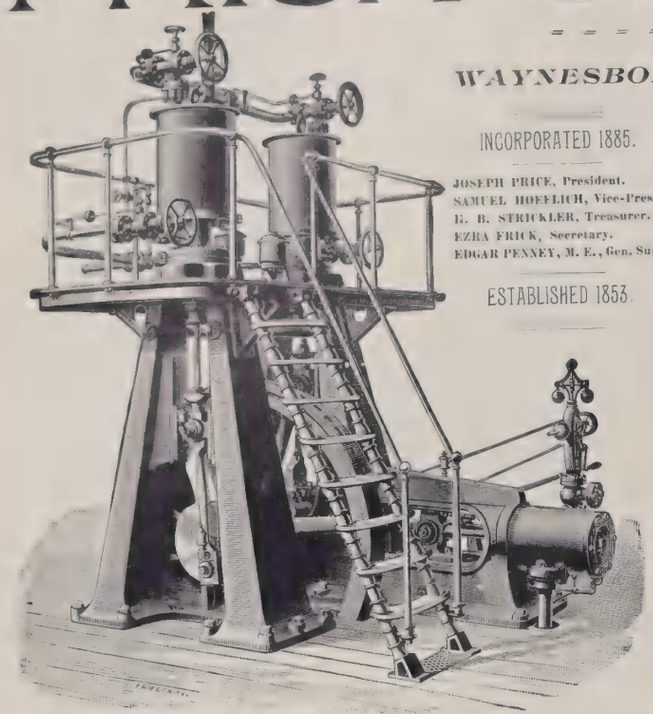
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
B. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

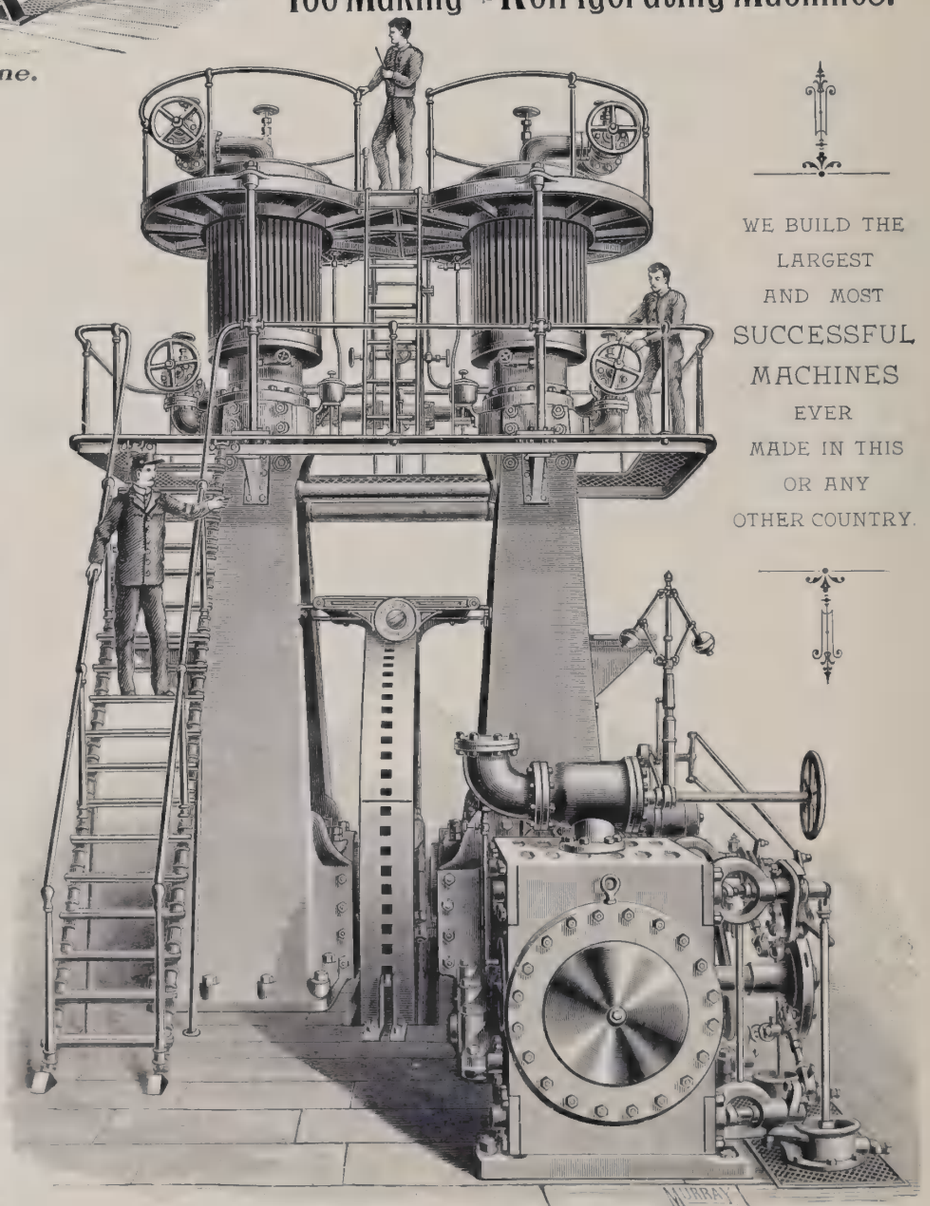
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order).	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsburgh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, N. b.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co. W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., Owensboro, Ky	20
W. S. Lawton, Jacksonville, Fla.	15
Palestine Ice Co., Palestine, Texas	5
Armour Packing Co., Kansas City	75
Ewing & Boyd, Connellsville, Pa.	15
S. W. Hall, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

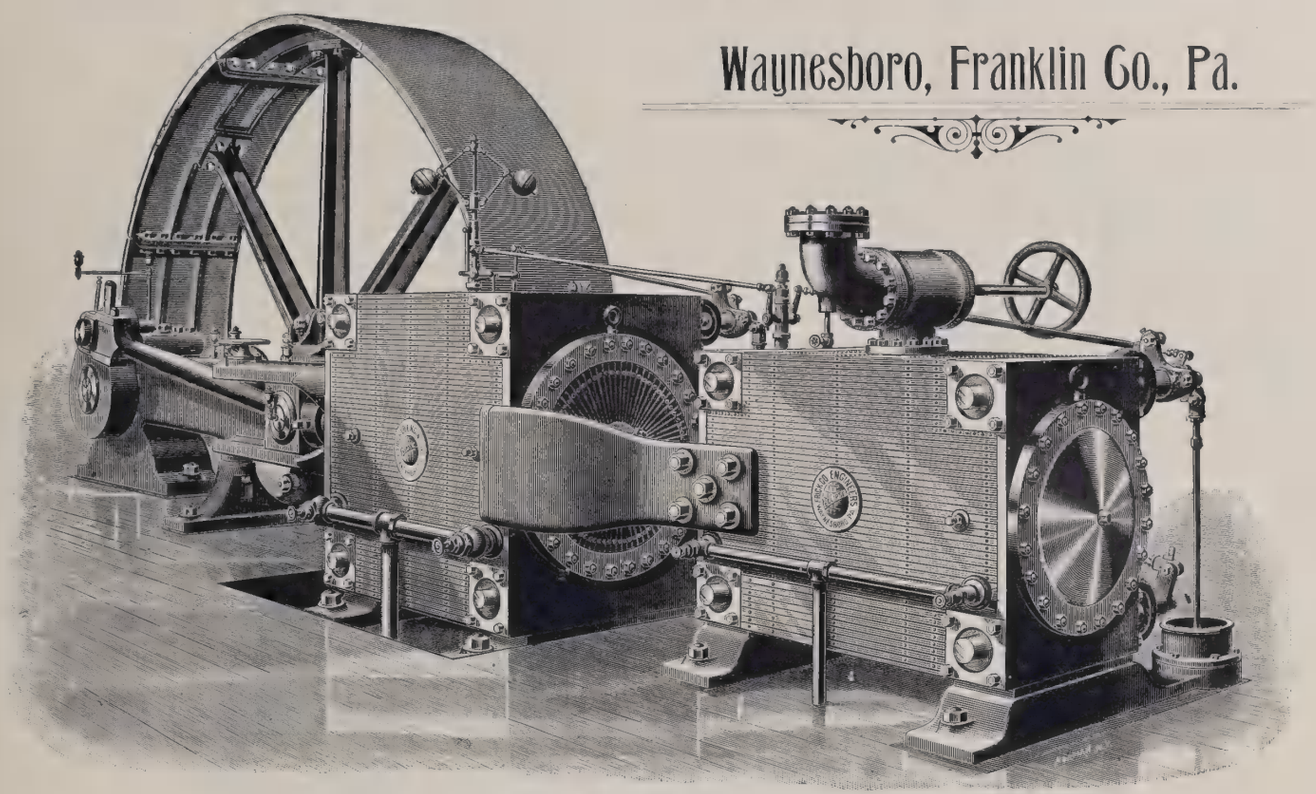


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

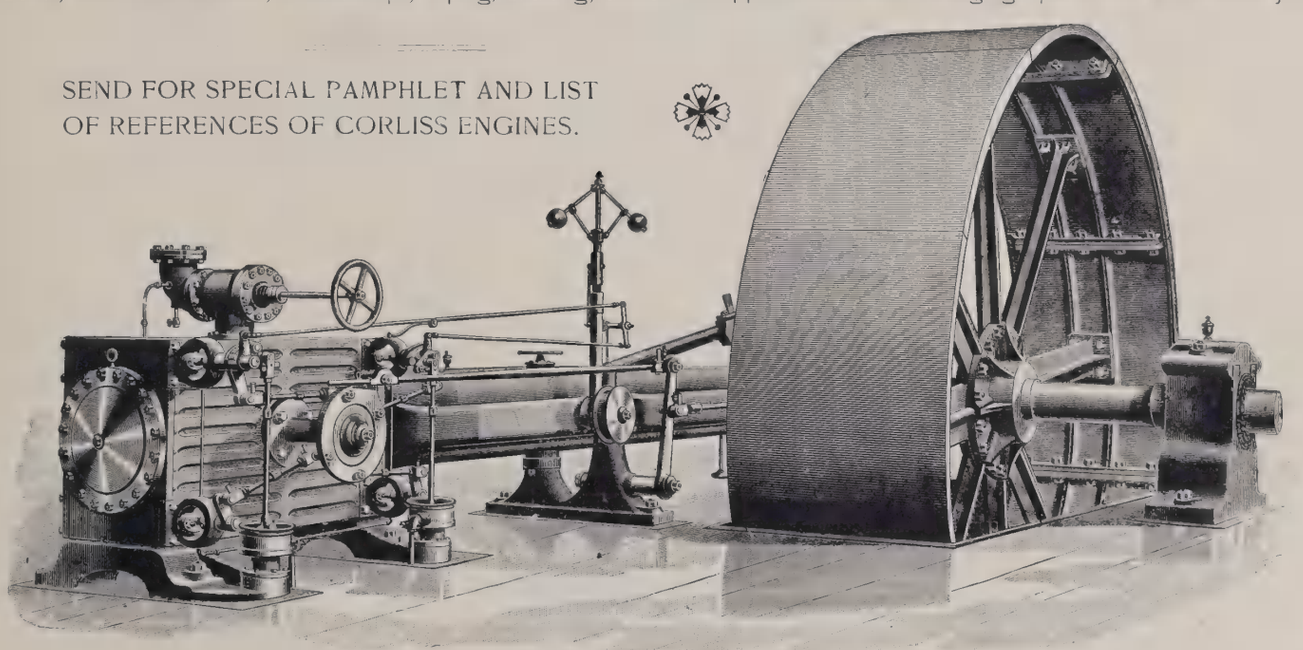
"ECLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "ECLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

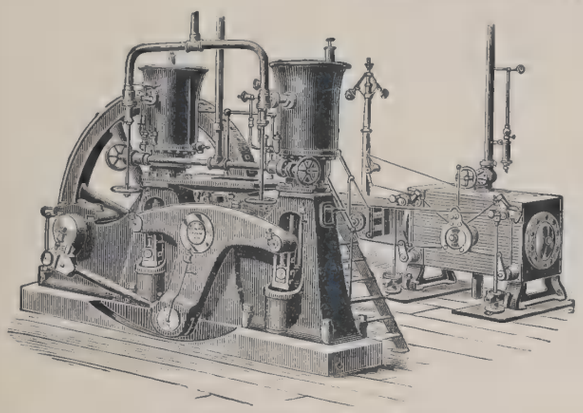
Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION.....

PITTSBURGH, PA.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)



THE HERCULES ICE MACHINE.

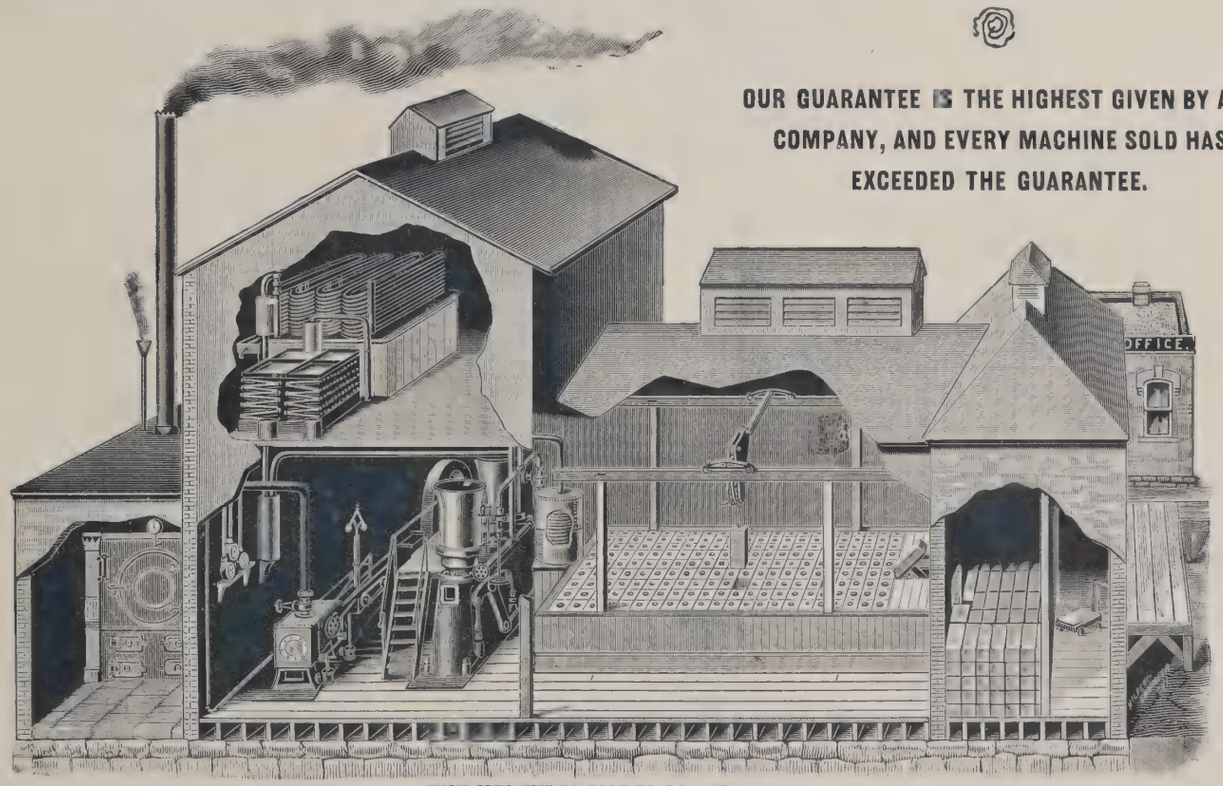
The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.



THE HERCULES MODEL ICE PLANT.

THE JACOB DOLD PACKING CO.,
PORK AND BEEF PACKERS,
BUFFALO, N. Y., Feb. 8, 1892.

DEAR SIRS: In reply to your inquiry in regard to the working of the five Ice Machines I purchased from you during the past few years, would say that they are all right and in good running order. I have had no trouble with them, and they do their work very satisfactorily. The last 40-ton Ice Machine which I put in here at Buffalo (which is the same as three others I have) I use exclusively for ice making. We are making during the winter months from 55 to 58 tons of ice each twenty-four hours, and during the summer months we make about 50 tons each twenty-four hours with this machine, which is very satisfactory work for us. I am so well pleased with it that I would like to exchange some smaller ones of other makes for one more 80-ton machine of yours if I could find the room to place it in. Yours truly,

JACOB DOLD, President.

FORT WORTH PACKING CO.,
FORT WORTH, TEX., Nov. 17, 1891.

GENTLEMEN: As none of our officials were thoroughly conversant with Ammonia Refrigerating Machines, they appointed representatives to examine machines of different patterns throughout the country, and finally, after a thorough examination, decided upon yours—one 100 tons and one 50 tons. They have accomplished all they were put in for, and we are thoroughly satisfied with them in every respect. We have two large chambers which are refrigerated by the same, and have also shipped thousands of tons of ice from our packery, and everything has given satisfaction. In regard to fuel and water, which are of great importance in this country, they do not use as much fuel, nor any more steam and water than I have seen other machines use. In fact, we consider them very economical in that respect. I have been some eighteen years in the packing business, and have used and tested all the leading machines, but the "Hercules," in my estimation, is far superior to them all. We are well satisfied with our plant. Respectfully yours,

GEO. M. BARNUM, Gen. Mgr. Ft. Worth Packing Co.

THE HERCULES BLUE BOOK No. 1, ON ICE MAKING AND REFRIGERATION, IS JUST ISSUED AND WILL BE SENT FREE TO INTENDING PURCHASERS.

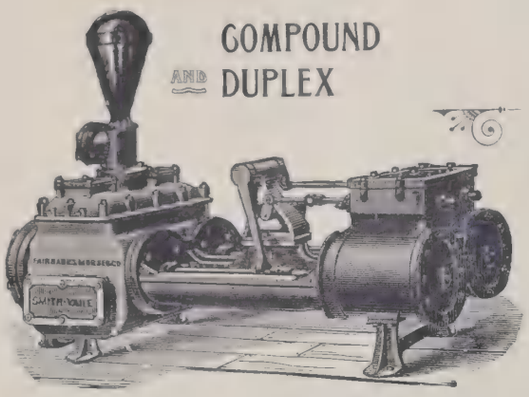
THE HERCULES IRON WORKS,

NEW YORK OFFICE, 150 BROADWAY. (1)

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.

WORKS, AURORA, ILL.

THE SMITH & VAILE CO. DAYTON, OHIO.



COMPOUND AND DUPLEX

STEAM PUMPS

FOR EVERY PURPOSE.

WE MAKE A SPECIALTY OF

BRINE PUMPS,
COLD WATER PUMPS,
BOILER FEED PUMPS.

FOR

Ice and Refrigerating Machines.

Get our Special Prices before buying elsewhere.

NEW YORK HOUSE, 112 LIBERTY ST.

THE GORDON STEAM PUMP CO.

BUILDERS OF

Steam Pumping Machinery

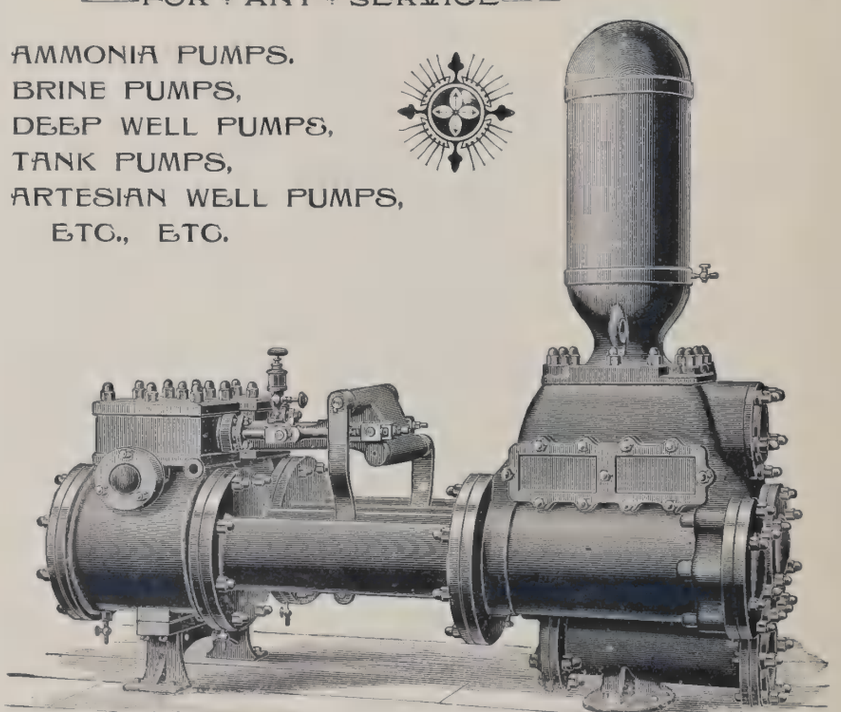
FOR ANY SERVICE

Pumps

ESPECIALLY ADAPTED FOR USE IN CONNECTION WITH

Refrigerating Machinery

AMMONIA PUMPS.
BRINE PUMPS,
DEEP WELL PUMPS,
TANK PUMPS,
ARTESIAN WELL PUMPS,
ETC., ETC.



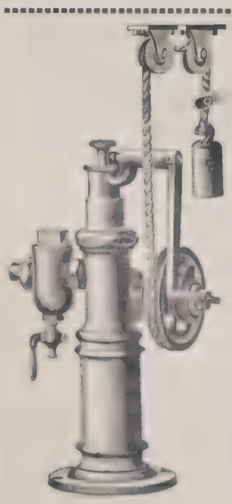
MAIN OFFICE AND WORKS

HAMILTON, OHIO.

BRANCH OFFICES

NEW YORK—136 Liberty St.
PHILADELPHIA—705 Arch St.
PITTSBURGH—410 Lewis Block.
CHICAGO—Phœnix Building.
ST. LOUIS—703 Market St.
CLEVELAND—146 Water St.

Correspondence Solicited.



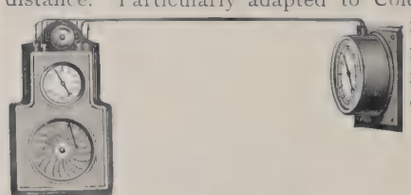
Damper Regulators

Our Steam Damper Regulator is the only one in which the steam itself both opens and shuts the damper. It will control the most powerful set of boilers. Each machine is nickel plated, and with it is furnished weight, bracket and twenty-five feet of chain, ready for setting up. The price is $80, net. We also manufacture other steam regulating specialties.

MASON REGULATOR CO.
BOSTON, MASS.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.



FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.
PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

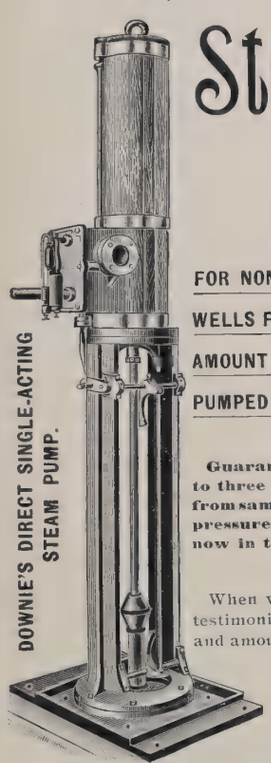
CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.

DOWNIE'S

DIRECT, DOUBLE-ACTING

Steam Pump



FOR NON-FLOWING ARTESIAN WELLS FROM WHICH A LARGE AMOUNT OF WATER IS TO BE PUMPED . . . . . .

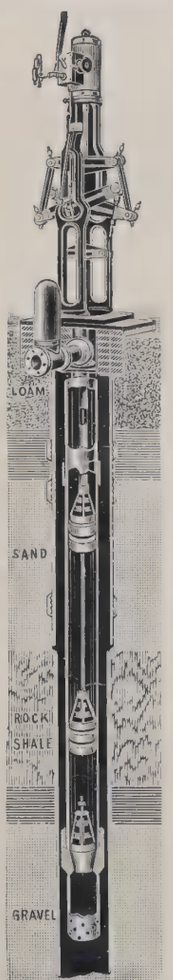
Guaranteed to lift from two to three times as much water from same well and same steam pressure as any other Pump now in the market.

When writing for prices and testimonials, give depth of well and amount of water wanted.

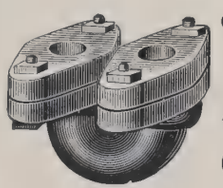
Sole Patentees and Manufacturers,

Downie Bros. & Nevin, Limited

NEW BRIGHTON, PA.



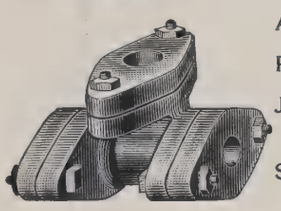
General Ice Factory Supplies



GLAND END AMMONIA FITTINGS AND VALVES,

ASBESTOS PACKED COCKS,

CHAPMAN AMMONIA GATE VALVES,

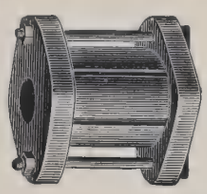


Automatic Ammonia Gauges

Pressure & Vacuum Gauges

Jenkins and Rainbow Sheet Packings,

Selden's Stuffing Box Packing,



Elastic and Sectional Ring Packings,

PURE GUM RINGS—ALL SIZES,

STEAM FITTINGS, TOOLS, Etc.

SEND FOR **416** PAGE ILLUSTRATED CATALOGUE.

RIPLEY & BRONSON,

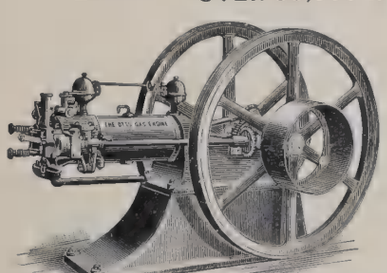
800 North Second St.,

ST. LOUIS, MO.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

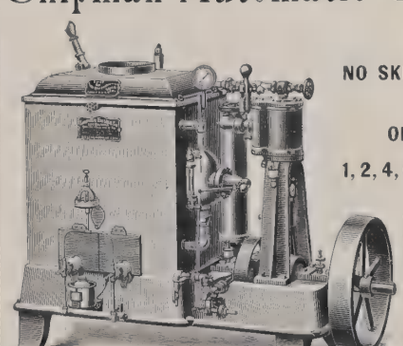
Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

THE

Shipman Automatic Steam Engine



NO SKILLED ENGINEER.

KEROSENE, PETROLEUM OR NATURAL GAS FUEL.

1, 2, 4, 6 and 8 HORSE POWER.

The most reliable, economical and satisfactory power for small

REFRIGERATING MACHINES, CREAMERIES, PACKING HOUSES, BOTTLERS, COLD STORAGE, Etc.

Send for Catalogue. . . . .

SHIPMAN ENGINE CO., 328 Summer Street, **Boston, Mass.**



The "STEAM JACKET"
BOILS THE WATER.

WM. BARAGWANATH & SON,

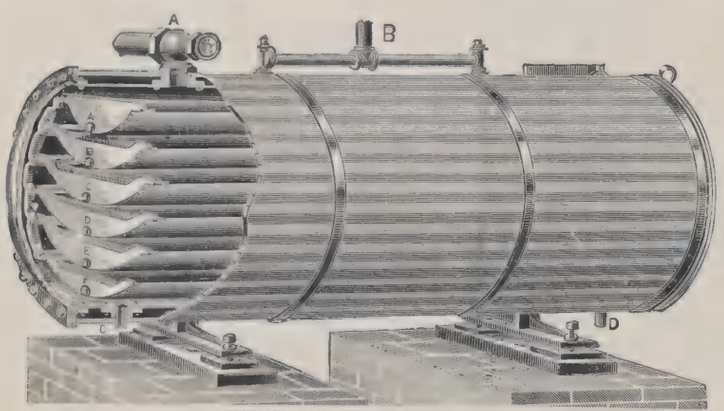
48, 50 & 52 WEST DIVISION STREET,

CHICAGO.

.....MANUFACTURERS OF.....

EXHAUST FEED WATER HEATERS
LIVE STEAM FEED WATER PURIFIERS
POWER PUMPS, ETC., ETC.

SEND FOR CIRCULARS.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

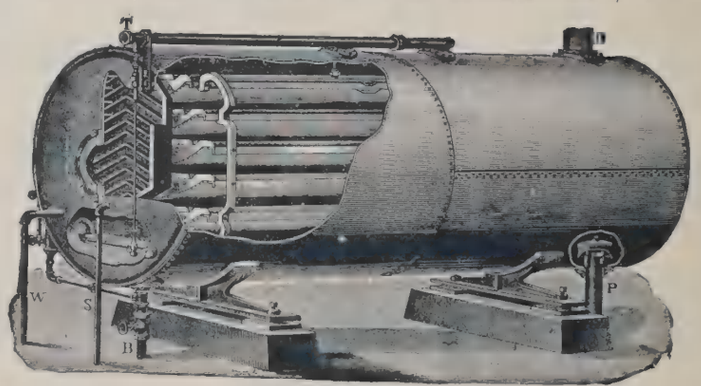
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT
OF YOUR EXHAUST STEAM,
INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



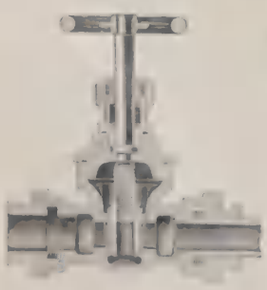
HOPPES EXHAUST HEATER

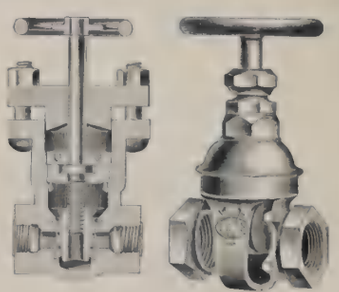
CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

VALVES AND GATES

FOR WATER, STEAM, GAS, OIL, AMMONIA, ACID, ETC.; ALSO GATE FIRE HYDRANTS.





We give special attention to Valves for Ice and Refrigerating Machinery.
We make the best Ammonia Valves in the market.
Send for particulars.

TREASURER'S OFFICE.
72 KILBY STREET, BOSTON, MASS.

GENERAL OFFICE AND WORKS:
INDIAN ORCHARD (SPRINGFIELD), MASS.

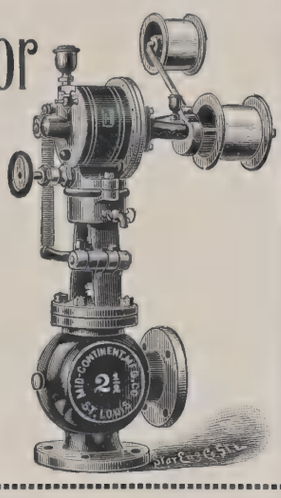
CHICAGO OFFICE AND SALESROOM,
24 WEST LAKE STREET.

◇◇◇ THE ◇◇◇

Brazelle Governor

A Slide Valve Equal to an Automatic.

PERFECT REGULATION
ECONOMY OF FUEL
INCREASE OF POWER



Printed Proposition and Guarantee of Better Service.

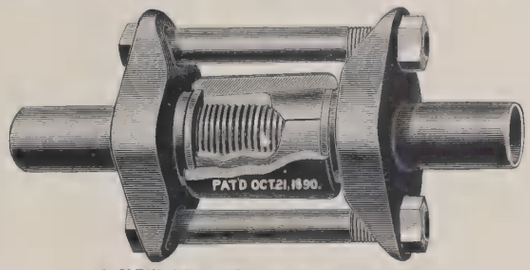
Mid-Continent Manuf'g Co.

16 S. COMMERCIAL, ST. LOUIS, MO.

Report of the 6-inch Governor placed in Bellefonte Iron Works, Ironton, O.

With boiler pressure 90 lbs. the old Governor gave 32 lbs. in the cylinder; with boiler pressure 80 lbs. the Brazelle Governor gave 55 lbs. in the cylinder, and the Mill rolled 10 tons of iron per day additional.

THE CLIMAX COUPLING



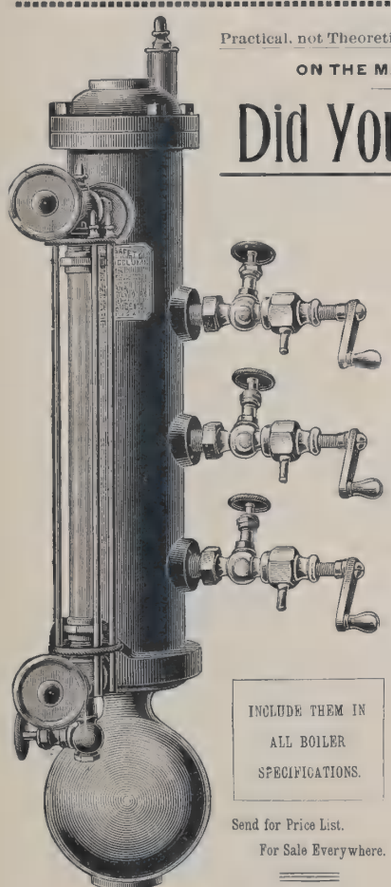
A NEW AND ORIGINAL INVENTION.

Unsurpassed for Efficiency, Strength, Durability and Economy.

Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia. For further information, testimonials, prices, etc., address

ENOCH LAWSON,

229 FULTON STREET,
SAN FRANCISCO, CAL.



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.
For Sale Everywhere.

The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

EVERY ONE A GEM. EVERY ONE POPULAR.

IT WILL PAY YOU TO INVESTIGATE THE

LUNKENHEIMER .·. SPECIALTIES

STRICTLY FIRST-CLASS AND WARRANTED.

SEND FOR CATALOGUE AND DISCOUNTS.


Check Valve, Fig. 205.


Handy Valve, Fig. 199.


Ball Check, Fig. 209.


Plain Grease Cup, Fig. 319.


Junior, Fig. 299.


Senior, Fig. 298.


Joker, Fig. 337.


Oil Pump, Fig. 300.


Pist. Wh'tle Fig. 241.


Pop Valve, Fig. 231.


Automatic Grease Cup, Fig. 318.


Throttle Valve, Fig. 229


Gate Valve, Fig. 227.


Pioneer, Fig. 305.


Royal, Fig. 306.


Crown, Fig. 308.


Globe Valve, Fig. 200.

FOR SALE BY DEALERS, OR WRITE

THE LUNKENHEIMER BRASS MFG. CO., Cincinnati, O., U. S. A.

Rogers . Patent . Grate

Please note date of patent, June 22, 1886.

TOP AND SIDE VIEW.



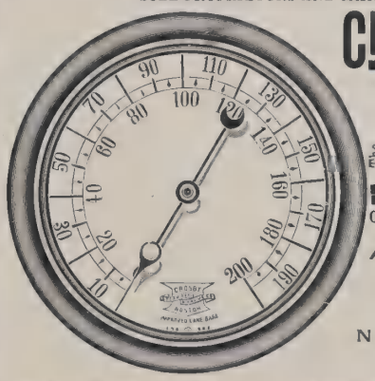
Cheapest Grate Bar in use, and second to none in Durability and Economy in the use of Fuel. BEWARE of INFRINGEMENTS and Inferior Imitations Structurally Weak . . . . . .

ARGAND GRATE BAR CO.

110 Liberty St., NEW YORK.

Crosby Steam Gage & Valve Co.

SOLE PROPRIETORS AND MANUFACTURERS OF



CROSBY Pop Safety Valves. Water Relief Valves. Steam Pressure Gages. Engine Indicator.

Victory Steam Cylinder Lubricators, Single Bell Chime Whistles, Patent Gage Testing Apparatus.

The BOSWORTH Pump Governor. Pressure Regulator and Feed-Water Regulator

Clark's Linen Fire Hose and Couplings and many other Specialties.

AMMONIA GAGES

And all other Pressure and Vacuum Gages used in the Arts.

BRANCHES:
NEW YORK, CHICAGO, and LONDON, ENG.

Main Office & Works: BOSTON, MASS., U. S. A.

THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

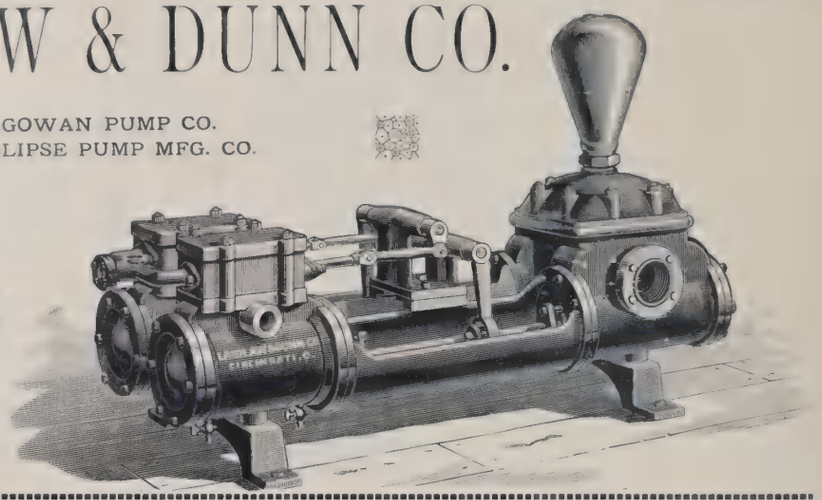
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.

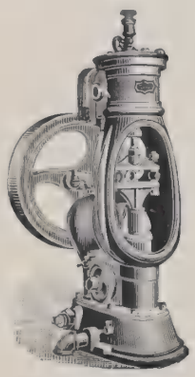


AMMONIAL LIQUID . . . .

PUMPS

FOR USE IN.....

ICE MAKING AND
REFRIGERATING PLANTS



These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

VALLEY PUMP CO.

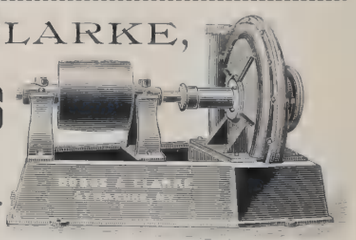
EASTHAMPTON, MASS.

BOGGS & CLARKE,

MANUFACTURERS OF

Centrifugal Pumps

FOR CIRCULATING BRINE
And all other Liquids.
123 & 125 SOUTH CLINTON STREET,
SYRACUSE, N. Y.



CRANE COMPANY, CHICAGO.

SPECIAL WROUGHT IRON PIPE

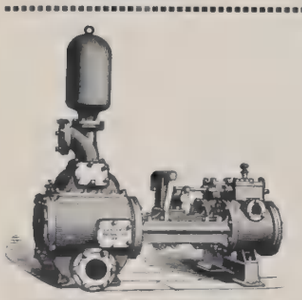
. . . . . For Ice Making and Cold Storage.

DEAN BROS.

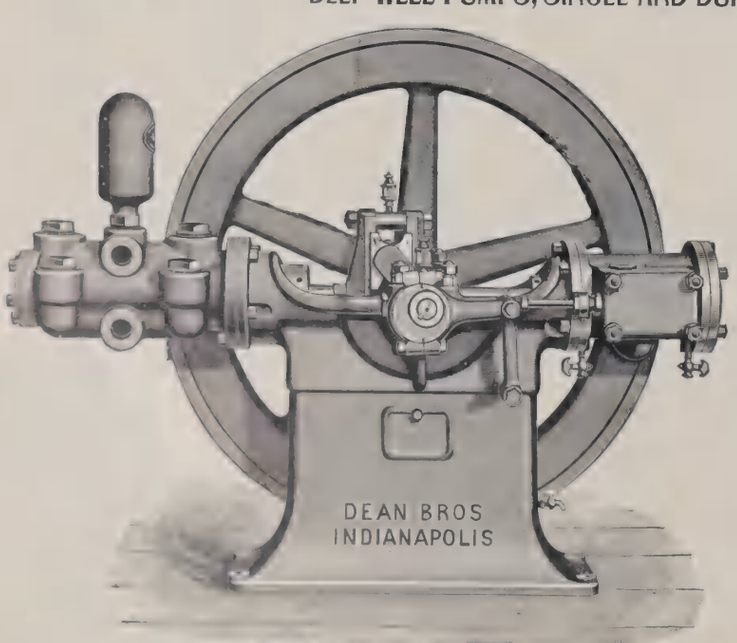
Steam Pump Works

INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.

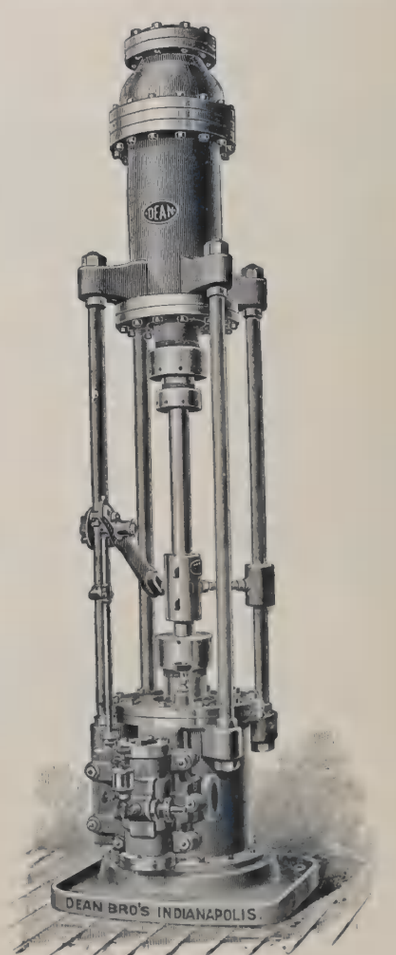


DUPLEX WATER SUPPLY PUMP.



HORIZONTAL AMMONIA PUMP.

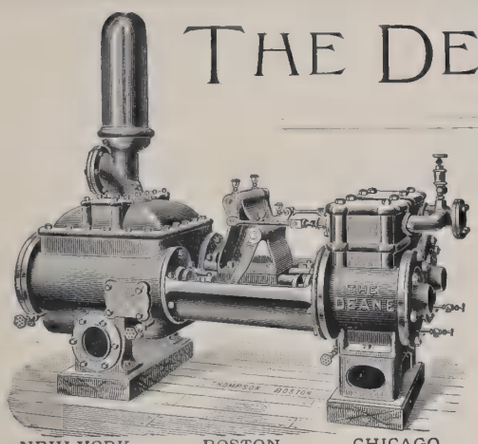
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's
Patent
Tube
Well
Strainers

..... AND .....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

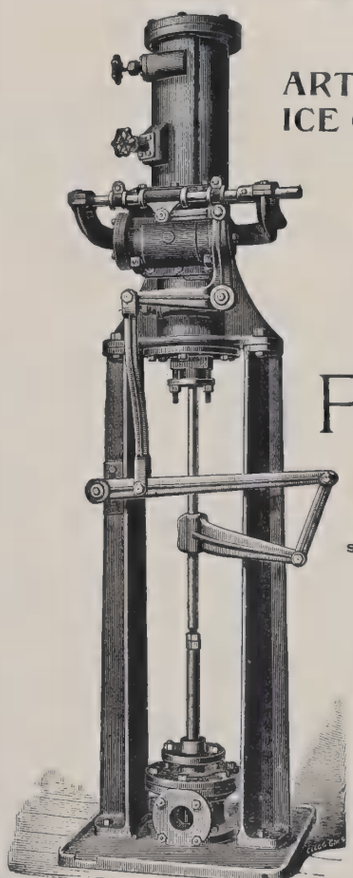
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

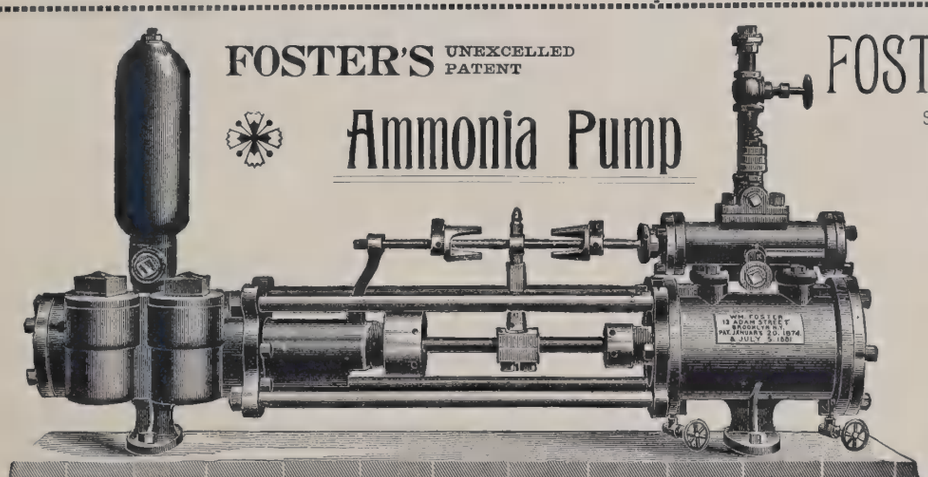
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuff-

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

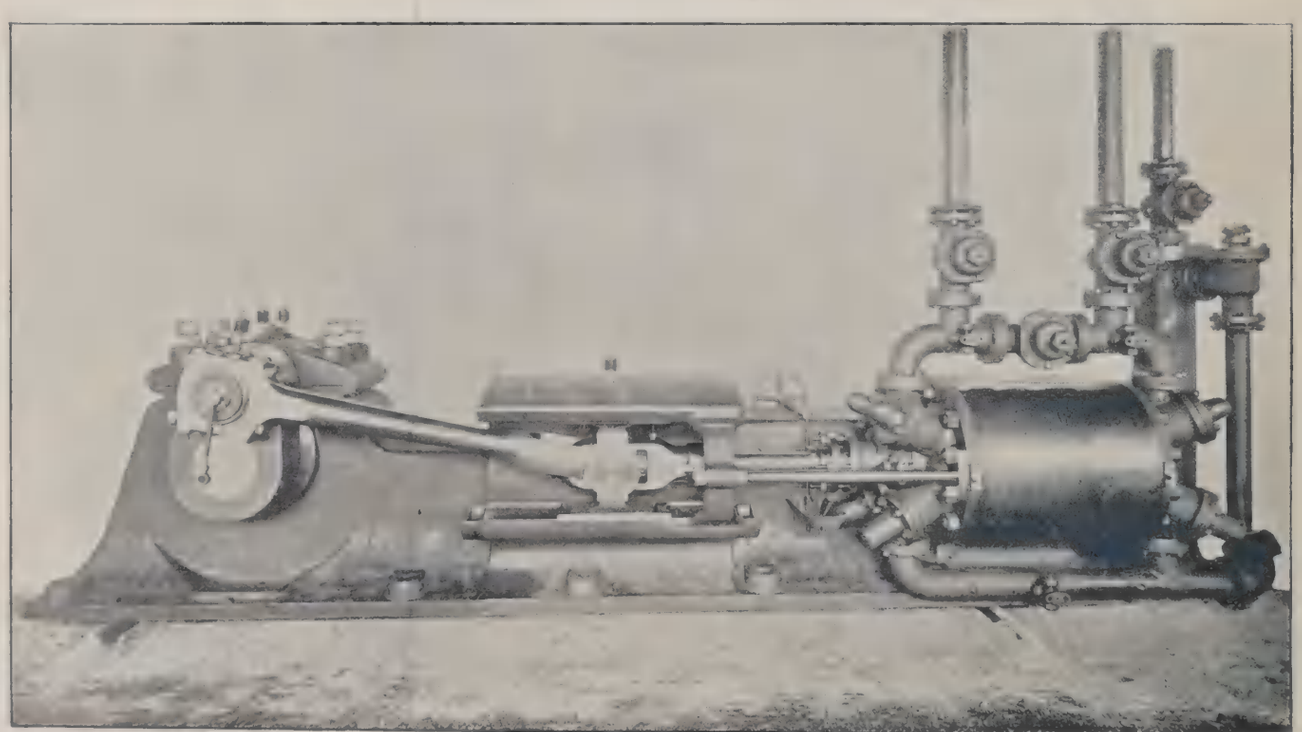
All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.

THE FRED W. WOLF CO.

MANUFACTURERS OF THE

Linde Ice AND Refrigerating Machine

560 North Halsted Street CHICAGO, ILL. U. S. A.



No. 8 Linde Compressor, 100 Tons Capacity.

FOR

Correspondence Solicited . . . .

ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. II. NO. 4. CHICAGO : NEW YORK : APRIL : 1892. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

AMMONIA COMPRESSION MACHINES.

A METHOD PROPOSED FOR SOLVING THE PRACTICAL PROBLEMS OF REFRIGERATION BY MEANS OF A DIAGRAM AND SLIDE RULE—A STUDY OF COMPRESSION MACHINES.

BY GEORGE RICHMOND, M. E.

[*Continued from March issue, page 184.*]

WORK.—On the diagram (page 182) are shown two curves marked maximum and minimum work. The first of these represents the variation of work necessary to compress a cubic foot of atmospheric air from the different pressures marked in the base line to that of the condenser, on the supposition that no heat is imparted to the air by the process of compression, or rather, that the heat is removed as fast as generated. The second in the same way represents the variation of work necessary to compress the same air on the supposition that no heat is removed during compression. An ordinate drawn to either curve from a given pressure marked on the base line measures the work necessary to compress a cubic foot of air from that pressure to 140 pounds. Each unit on the scale represents .024-horse power for every cubic foot per minute passed through the compressor. To find the total work in any given compressor, multiply the volume per minute by this number, and by the height w to the work curve, and the result will be the work required in horse power.

$$W = V \times w \times .024 \qquad (9)$$

The equation to curve of minimum work is

$$w = 144\, p_2 \log^e \left(\frac{p_1}{p_2}\right) \qquad (10)$$

since in our unit cylinder $V_2 = 1$.

For the curve of maximum work the equation is:

$$w = \frac{144\, K\, p_2}{K-1}\left(\left(\frac{p_1}{p_2}\right)^{\frac{K-1}{K}} - 1\right) \qquad (11)$$

In both of these p_1=condenser pressure, and p_2= back pressure, and in (11) $K = 1.41$.

The curve of isothermal, or minimum, work has been arranged to have a value (10) at the same pressure that the refrigeration curve has this value. This enables us to compare the work with the refrigeration by simple inspection. We see at once that although the work curve falls, as does the refrigeration curve, when low temperatures are used, yet that representing work falls much less rapidly, and that the ratio between the work done and refrigeration produced is a constantly increasing one.

Thus a machine which has a refrigerating capacity represented by (10) at 15° yields 80 per cent only of this amount at 5°, while the work ordinate at the same temperature is 9.38 divisions or 93.8 per cent, so that while the capacity is diminished 20 per cent, the work is diminished only 6.2 per cent. It will be noticed that each work curve crosses the base line at the condenser pressure, for it is evident that no refrigeration is performed, and therefore no work done, when the refrigerator and condenser have the same temperature. By continuing beyond this point the apparatus becomes a heat engine, for when the temperature of the refrigerator is greater than that of the condenser it is a source of energy, and with suitable valve motion would drive the compressor. Under these circumstances the refrigerator represents the boiler, and the compressor the engine. The curve representing the actual work of compression for ammonia will lie between these two, and will vary in position for different systems of working, being nearer the lower curve the greater the amount of cooling done during compression. To avoid controversy it has been deemed advisable to draw two fixed boundary lines, representing well established facts.

The work of compression may be fixed between narrower limits than those of the isothermal and adiabatic curves for air, neither of which represent actual facts as applied to ammonia. It may be observed that *isothermal* compression has no place in refrigeration; the utmost to be desired being that the ammonia should have at the end of compression the same temperature as the condenser. The maximum economy would be obtained by removing the heat as generated up to this point, and compression would take place along the *saturation curve*. The curve for the adiabatic compression of dry ammonia is very closely represented by the relation

$$P V^{1.3} = \text{constant}.$$

These two curves are then the real boundary lines between which the curves of compression lie, and the work along these latter differs only by a small fraction of the total work.

The saturation curve may be constructed directly from the table (page 110, Vol. II, column 3) giving the pressures, and, column 5, the corresponding volumes. The most convenient way of using the table is to divide

the volume (or stroke) decimally, say into 100 parts, then divide the volume corresponding to the back pressure by one one-hundredth of itself, and also the other volumes by the same number. In this manner we get (supposing 42.93 the back pressure)—

P	V
42.93	100
47.95	90.3
53.43	82.8
etc.	etc.

where $90.3 = \frac{5280}{645}$

For the adiabatic curve we have

$$P_1 V_1^{1.3} = P_2 V_2^{1.3} \quad \text{whence}$$
$$log.\ P_1 = log.\ P_2 + 1.3\ log.\ V_2 - 1.3\ log.\ log.\ V_1$$

Now $log.\ P_2 + 1.3\ log.\ V_2$ is always known, since P_2 is the back pressure and V_2 the volume (as measured by the stroke) and we proceed as follows, assuming for the purpose of illustration that $P_2 = 42.93$ and $V_2 = 100$; then

$$log.\ 42.93 + 1.3\ log.\ 100 = 4.23276.$$

	4.23276		
V	$1.3\ log.\ V$	$log.\ P$	P
95	2.57104	1.66172	45.9
90	2.54051	1.69225	49.3
85	2.50825	1.72451	53.0
etc.	etc.	etc.	

The column under $log.\ P$ is obtained by adding 4.23276 to the corresponding number in the previous column. If a large number of curves are to be drawn, the work may be abridged; the arrangement shown, however, applies to any table of properties of ammonia, or any modification of the value of the exponent 1.3; and by proper adjustment of this exponent a curve of the same family may be drawn, which will, for all practical purposes, coincide with any of the intermediate curves of compression.

In addition to the actual work of compression an allowance must be made for friction, etc. This will consist of the frictional load of the apparatus (engine and compressor) running without doing the work of compression, together with a variable addition due to the conditions under which the work is done, and which must take account not only of the extra friction due to the load but also of the following facts:

1. That there is a certain load for which the engine uses the steam with maximum efficiency, and any variation of this will decrease the efficiency.

2. That the same influences which decrease the refrigerating effect will also affect—and generally decrease—the work of compression.

3. That the efficiency of the engine, as well as that of the compressor, is affected by the speed, and generally in opposite directions. There is very little hope of tracing with complete accuracy the amount contributed by each of these various influences, but the general deduction from these and the foregoing considerations is, that to secure the maximum efficiency under given conditions, the apparatus as a whole should be proportioned with reference to those conditions.

Whatever allowance, therefore, is chosen, it must be strictly empirical, and subject to confirmation by reference to actual practice. For the purpose of solving approximately some practical problems relating to the work of refrigeration, we will assume that the actual work required is represented by the curve of *adiabatic* work, with about 12 per cent addition.

This will make, equation (9),

$$W = V \times w \times .024 \times .12$$
or
$$W = .0283\, Vw \qquad (12)$$

Example 9.—What is the power required to drive a 10″×30″ double-acting machine, running at forty revolutions and temperature of 15°? In this case $V = 109$, and $w = 12.1$, therefore

$$W = .0283 \times 109 \times 12.1 = 37\ horse\ power.$$

The practical capacity of this machine was found to be thirty-one tons, therefore the *horse power* per ton of refrigeration is $\frac{37}{31} = 1.2$ nearly. In general, the horse power required per ton may be approximately obtained from the equation

$$P = \frac{.0283\, w}{.02831\, R}$$

or, more simply,
$$P = \frac{w}{R} \qquad (13)$$

where P = horse power per ton, w = ordinate to maximum curve, and R = ordinate to refrigeration curve.

If R' = refrigeration in tons per day per horse power,

$$R' = \frac{R}{w} \qquad (14)$$

Both of these can be read directly from the diagram. The rules expressed in words are:

1. To find the horse power per ton of refrigeration at any temperature, *divide the height to the maximum work curve by the height to the refrigeration curve.*

2. To find the amount of refrigeration per horse power, *divide the height to the refrigeration by that to the maximum work curve.*

The following table gives the values of P and R' for various temperatures of the expansion coil:

Temperature in expansion coil.....	30°	25°	20°	15°	10°	5°	0°	−5	−10
H. P. per ton refrigeration $\left(\frac{W}{R}\right)$.....	.88	.97	1.1	1.28	1.35	1.47	1.61	1.77	1.9
Tons refrigeration per H. P. $\left(\frac{R}{W}\right)$ ...	1.14	1.03	.91	.78	.74	.68	.62	.56	.52

This table shows (as is also evident from the diagram) that the cost per ton of refrigeration increases notably as the back pressure is reduced, giving another argument for using as high a back pressure as is practicable. It must be remembered that the horse power all along has been considered in relation to a back pressure of about 140 pounds, and the table is calculated on this assumption. The machine must be provided, of course, with engine capacity considerably in excess of this, since the pressure is liable to be very much greater.

The dotted curve of maximum work represents the work done when the condensing pressure is 200 pounds instead of 140 pounds. For this pressure, therefore, the work ordinate w must be measured to this dotted line. To intermediate pressures a proportional part of the difference may be added to the lesser ordinate.

With regard to the very much discussed question, how many tons of refrigeration can be produced with a ton of coal, it is evident that this must be dependent upon the coal consumption per horse power of the engine, and the conditions of temperature under which the machine is run. If h be the consumption of coal per horse power in pounds per hour, and T be the tons of refrigeration per ton of coal, then we have

$$T = \frac{2000}{24\, h}\left(\frac{R}{w}\right) \quad \text{or}$$
$$T = \frac{83}{h}\left(\frac{R}{w}\right) \qquad (15)$$

From this has been calculated the following table giving the tons refrigeration per ton of coal at various temperatures and pressures in expansion coil, and for various consumption of coal per horse power, on the supposition that the high pressure is 140 pounds:

TONS REFRIGERATION PER TON OF COAL.

Temperature in expansion coil.	30°	25°	20°	15°	10°	5°	0°	—5°	—10°
2 lbs. coal per H. P.	47	43	38	33	30	28	26	23	21
3 lbs. " " "	31	28	25	23	20	18	17	15	14
4 lbs. " " "	24	21	18	16	15	14	13	12	11
5 lbs. " " "	19	17	15	13	12	11	10	9	8

COST.—The cost for fuel per ton of refrigeration will, of course, vary with the price of coal. If this be taken at m dollars per ton then the cost per ton of refrigeration, which we will call K, will be

$$K = \frac{m}{T} = \frac{mh}{83}\left(\frac{w}{R}\right) \qquad (16)$$

The curve marked *cost per ton for fuel* has been plotted from the values of $\frac{1000}{83}\left(\frac{w}{R}\right)$ so that the product of any ordinate to that curve by $m \times h$ gives the cost per ton (for fuel only) in units at the corresponding back pressure. The curve as drawn corresponds to a high pressure of 139 pounds, while the dotted curve of the same name gives the cost when the high pressure is 200 pounds.

We may collect our results for reference:

V = volume of gas passed through the compressor per minute.

h = lbs. of coal consumed per H. P.

m = cost of coal in dollars per ton.

R, w, K are the ordinates to the refrigeration work and cost.

For comparative results:

Practical capacity in tons per day ..... $R_1 : R_2$

Amount of work ..... $w_1 : W_2$

Cost per ton for fuel ..... $K_1 : K_2$

Tons refrigeration per H. P. ..... $\left(\frac{R_1}{w'_1}\right) : \left(\frac{R_2}{w'_2}\right)$

H. P. per ton of refrigeration ..... $\left(\frac{w'_1}{R_1}\right) : \left(\frac{w'_2}{R_2}\right)$

For positive results:

Practical capacity ..... $= .0283\ VR$ *tons.*

Work required ..... $= .0283\ Vw$ *H. P.*

Cost per ton in mills ..... $= m\,h\,k.$

Tons per H. P. ..... $= \frac{R}{w}$

H. P. per ton ..... $= \frac{w}{R}$

Tons refrigeration per ton of coal $= \frac{83}{h}\left(\frac{R}{w}\right)$

A few examples will illustrate the application of these results.

Example 10.—An engine uses four pounds coal per H. P., and the price of coal is $5 per ton; what is the cost per ton of refrigeration at 10°?

At 10° the height k of the cost ordinate is 16.1.

$$Cost = 4 \times 5 \times 16.1 \text{ mills} = 32.2 \text{ cents.}$$

Example 11.—What would be the cost at 160 pounds back pressure, other conditions being the same?

We add to k one-third of the distance from the full line to the dotted line; that is, $K = 16.1 + 1.26 = 17.37$.

$$Cost = 4 \times 5 \times 17.37 \text{ mills} = 34.7 \text{ cents.}$$

Example 12.—If 3.5 lbs. of coal are burned per H. P., how many tons of refrigeration per ton of coal shall we obtain at —5°?

$$Tons\ refrigeration = \frac{83}{h}\left(\frac{K}{w}\right) = \frac{83}{3.5}\left(\frac{6.3}{11.2}\right) = 13.3.$$

Example 13.—How many H. P. per ton of refrigeration are required at 20°, high pressure being 200 lbs.?

$$H.\ P. = \frac{w}{R} = \frac{15.5}{10.2} = 1.52.$$

Example 14.—If refrigeration cost twenty-five cents per ton when a machine is running at thirty-three pounds back pressure 140 high pressure, what will be the cost and at six pounds back pressure and 200 lbs. high pressure?

The cost is proportional to the corresponding heights of K, which are 13 and 29.5 respectively.

$$13 : 29.5 :: 25 : x$$
$$x = 56.7 \text{ cents.}$$

(TO BE CONTINUED.)

Written for ICE AND REFRIGERATION.]

TO COMPUTE CAPACITY.

III.—EFFECT OF THE SPECIFIC HEAT OF BRINE FOR VARYING TEMPERATURE REQUIREMENTS.

BY EDWARD C. POST, M. E.

(*Continued from March issue, page 170.*)

Having determined the effective ice-melting capacity of the compressor under varying temperature requirements, we will now calculate the amount of heat required by transmitting the ice-melting capacity of the compressor to some *refrigerating vehicle*. For this purpose we will employ *salt brine* in a well insulated tank of *1,000 cubic feet* contents. (10 ft. × 10 ft. × 10 ft.)

The brine for +40° will contain *5 per cent* of salt, which has a *specific gravity* of *1.037* and a *specific heat* of *.960.**

One thousand cubic feet of brine will weigh:

Cu. ft. tk. Wt. of 1 cu. ft. of water. Spec. grav. of brine.

$1{,}000 \times 62.4 \times 1.037 = 64{,}708$ *lbs.*

Lbs. of brine. Spec. heat of brine.

$64{,}708 \times .960 = 62{,}119$ *B. T. U.*

We find that it requires *2,589 B. T. U.* to transmit the temperature of the ammonia to the 1,000 cubic feet (64,708 lbs.) of brine, which is equal to *4 per cent.*

Deducting these 4 per cent from the effective ice-melting capacity of the compressor of 144.23 tons, leaves the *gross ice-melting* capacity of the *brine* at *138.46 tons.*

For a temperature of +20° we will employ brine containing *15 per cent* of salt, having a *specific gravity* of *1.115* and a *specific heat* of *.855.*

$$1{,}000 \times 62.4 \times 1.115 = 69{,}576 \text{ lbs.}$$
$$69{,}576 \times .855 = 59{,}487 \text{ B. T. U.}$$

The heat required to transmit the temperature of the ammonia in the expansion pipes to the 1,000 cubic feet of brine is *10,089 B. T. U.*

This is *14.5 per cent* of the 69,576 pounds stored in the tank. Deducting these 14.5 per cent from the effective ice-melting capacity of the compressor of 75.45 tons, we have the *gross ice-melting* capacity of the *brine* at *64.5 tons.*

Lastly, for a temperature of —25° we will employ brine containing 35 per cent of salt, having a *specific gravity* of *1.23* and a *specific heat* of *.730.*†

$$1000 \times 62.4 \times 1.23 = 76{,}752 \text{ lbs.}$$
$$76{,}752 \times .73 = 56{,}029 \text{ B. T. U.}$$

*For our investigation we will not make any allowance for space occupied in this brine tank by ammonia expansion coils, and it is supposed that the tank will contain 1,000 cubic feet of brine, and be full.

†The specific gravity of 1.23, as also the specific heat of .730, probably do not exist in the proportions assumed, but are near enough for the purpose of our calculation.

The heat required for transmitting the cooling efficiency from the ammonia to the 1,000 cubic feet (76,752 pounds) of brine is equal to *20.723 B. T. U.*, which is *27 per cent.*

Deducting these 27 per cent from the efficiency of the compressor of 19.45 tons, leaves the *gross ice-melting* capacity of the *brine* at *14.1 tons.*

Substituting these values into our table we have:

TABLE NO. 2.

Expansion temperature returning gas.	Condensing temperature.	Theoretic ice-melting capacity of compressor.	Effective ice-melting capacity of compressor.	Gross ice-melting capacity of brine.
+40	+ 60	100	99.38	*96.4*
+20	+ 80	53.39	51.96	*44.42*
—25	+100	15.57	13.4	*9.78*

IV.—ABSORPTION OF HEAT THROUGH INSULATION OF BRINE TANK.

No matter how well a brine tank may be insulated there must be a certain amount of heat which will pass through and warm up the brine contained in the tank, if the temperature of this brine is lower than that of the surrounding atmosphere. For our calculation we will assume that the temperature surrounding the tank stands at +80°, and that the insulation of the tank is such as to allow the transmission of 1.5 B. T. U. per square foot per degree difference of temperature of the atmosphere and that of the brine per day of twenty-four hours.

The opposed surfaces of the brine tank (10′×10′×10′) will be *600 square feet;* and we will further assume that the pipe (suction) conveying the ammonia from the expansion coils in the brine tank to the compressor, and the one conveying the refrigerating vehicle, brine, from the brine tank to the room to be subsequently cooled therewith, will each also contain *100 square feet* of radiating surface, making a total of *800 square feet* exposed to a temperature of +80°.

If we wish to maintain a temperature of +40° in the brine tank, the difference between the brine and that of the atmosphere will be *40°*. The amount of heat passing through the insulation of the tank and that of the connecting pipes will be:

$$\underset{\text{and pipes.}}{\text{Sq. ft. of Tk.}} \times \underset{}{\text{Dif. of temp.}} \times \underset{\text{sq. ft.}}{\text{Heat units per}} = 48{,}000 \text{ B. T. U.}$$

$$800 \times 40 \times 1.5 = 48{,}000 \text{ B. T. U.}$$

which must be cared for by the compressor.

$$\frac{\text{B. T. U. per day.}}{\underset{\text{S. H. of ice.}}{142} \times \underset{\text{Lbs. per ton.}}{2{,}000}} = .169 \text{ tons.}$$

$$\frac{48{,}000}{142 \times 2{,}000} = .169 \text{ tons.}$$

.169 tons is *.122 per cent* of the gross ice-melting capacity of 138.46 tons of the brine, which, when deducted, leaves the *net ice-melting* capacity of the *brine* at *138.3 tons* per day.

For maintaining a temperature of brine at +20° the amount of heat passing through the insulation will be:

$$800 \times 60 \times 1.5 = 72{,}000 \text{ B. T. U.}$$

$$\frac{72{,}000}{142 \times 200} = .253 \text{ tons}$$

which is *.392 per cent* of the gross ice-melting capacity of 64.5 tons, leaving the *net ice-melting* capacity of the *brine* at *63.24 tons* per day.

Likewise for a temperature of —25°, the heat passing through the insulation is:

$$800 \times 105 \times 1.5 = 126{,}000 \text{ B. T. U.}$$

$$\frac{126{,}000}{142 \times 2{,}000} = .443 \text{ tons.}$$

.443 tons is *3.14 per cent* of the gross ice-melting capacity of 14.1 tons, leaving the *net ice-melting* capacity for a temperature of —25° at *13.65 tons* per day.

Substituting these new values into our table, we have:

TABLE NO. 3.

Expansion temp'rature returning gas.	Condensing temperature = discharged gas	Theoretic ice-melting capacity of compressor.	Effective ice-melting capacity of brine.	Gross ice-melting capacity of brine.	Net ice-melting capacity of brine.
+40	+ 60	100	99.38	96.4	*96.28*
+20	+ 80	53.39	51.96	44.42	*44.24*
—25	+100	15.57	13.4	9.78	*9.47*

(TO BE CONTINUED.)

ONE of the great advantages of the electric system of heating, says an electrical journal, lies in the evenness with which the metal is heated, the interior of the metal being heated first and the rest of the mass uniformly and gradually. Objects can therefore be forged by the electric process in one heat, which before required two or three heatings in furnaces. The metal forgings are also much more reliable than formerly. Again the quickness with which any piece of metal can be heated is in many cases particularly advantageous, as a few inches back from the part under treatment the metal is quite cool and can be comfortably handled. Probably one of the greatest advantages, however, lies in the fact that during the process of heating there are no gases developed, nor is there any foreign substance present to enter into the metal. So that the metal, whether it be iron, steel, brass or composition, is, after being heated electrically, entirely without scale, a condition that it is impossible to secure by any other method.

A PRESS telegram from Muncie, Ind., says: "Wm. S. Furrow, a prominent citizen of Blackford county, was in the city recently and related a little incident at Mill Grove which may result in bringing into existence a new and very remunerative industry to the natural gas fields. A service line of natural gas had frozen and a joint of pipe was detached. The workman pounded on the pipe and a cylinder of ice about a foot in length dropped out. One of the men picked it up and applied a match, and the ice burned like a torch. The idea suggested is that natural gas may be frozen and transported. Capitalists are now making investigations with that end in view if the process should prove practicable. It is known that certain gases can be liquefied under strong pressure and this, no doubt, furnishes a solution of the phenomenon."

THE possible thickness of ice on Wisconsin lakes was recently the subject of discussion at Madison, when an old resident, in corroboration of the statement that ice had been seen on Madison's lake three feet thick, said: "Nearly twenty years ago when the late Joseph Schweinem was in the ice business here, he erected a crystal column in front of one of our saloons. There were three blocks, one upon the other; and they were as square almost as they could be. I took out my rule and measured the column. It was exactly nine feet nine inches high. This would make the blocks three feet three inches thick."



[*Written for* ICE AND REFRIGERATION.]

THE FREEZING PROCESS OF MAKING EXCAVATIONS.

SOME FURTHER DATA ON THE USE OF REFRIGERATING MACHINES IN CIVIL ENGINEERING—FREEZING ALTERNATE LAYERS OF DIFFERING EARTHS—THE PLUGGING OF CIRCULATING PIPES.

BY AUGUSTE J. ROSSI, B. S., C. E.

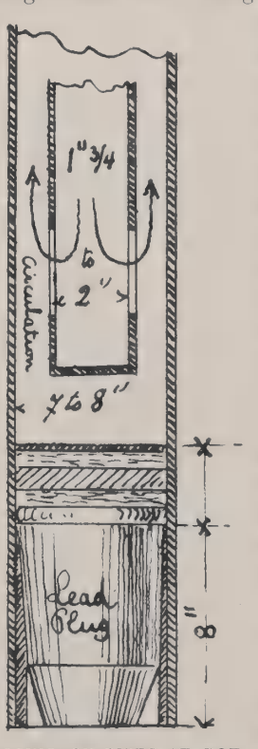
The very elaborate article of Mr. Moran which has appeared in your columns, describing the freezing process for sinking shafts in aquiferous sands at the Chapin mine, covers very completely the practice of the Poetsch method as carried out in this country. The data furnished, coming from an engineer personally in charge of the work, are of course of great value. As this method has attracted, and continues to attract, the attention of engineers in Europe and here, as an illustration of what artificial refrigeration can accomplish, we believe that some complementary data, obtained from absolutely reliable sources, and a few comments on the process itself will prove of interest to the profession.

All applications made so far of the method have been successful; it has passed the experimental stage ; and it comes at a time when its need is more particularly felt. The tendency of our days is to make deeper and deeper foundations for bridges intended to cross important streams; to pass under the beds of rivers by means of tunnels; and, though the use of the pneumatic process (compressed air) has rendered and does render great services in such cases, this last is limited, so to speak, by the difficulties, even the dangers to life encountered, owing to the extreme pressures required in the caissons to keep the water out when very important depths are reached. We will see further how Mr. Poetsch has proposed, and has lately contracted for the building of piers in deep waters by his method. The different stages of the operations, their details as carried on in this country, have been explained and illustrated by Mr. Moran, and we will not insist upon them, referring on the contrary to his article for a better understanding of what follows.

No ice or refrigerating machine of a special type is required in carrying out the process. In Stockholm, where a short tunnel was constructed directly under the foundations of high buildings by this method, an air machine of the type Lightfoot was the cold producing apparatus chosen. In other works executed by Mr. Poetsch himself, an absorption ammonia machine of the Carré type was used; and in this country, at the Chapin mine, a compression ammonia machine, as stated by Mr. Moran.

The question has been raised, How would the method work in grounds of different nature, such as one presenting alternate layers of aquiferous sands, clay, etc. In all the applications made so far, here and elsewhere, a good solidification has been invariably obtained between the congelated mass and solid ground whenever the cold brine circulating pipes have penetrated the latter ground. At the Elmira mine on the main line from Dresden to Berlin, it has been ascertained from actual and careful experiments that the blocks, partly of sand, partly of lignites, were of such consistency that, broken with a hammer, there was no separation of the heterogeneous elements. It would seem that such ought to have been the case, whatever the different constituting materials of the soil might be, when we observe in winter, after a sharp cold, successive layers of grounds of different nature strongly solidified and congealed together, in conditions in which the moisture of the ground cannot in any way be compared to the water of aquiferous sands!

At the Elmira mine great attention was given to the closing of the circulating pipes at the bottom. The pipes were placed about three feet from each other (one meter) on the circumference of the circle intended to be frozen. As described by Mr. Moran, they had a double circulation, being formed of two concentrical tubes, the inside one of a diameter of about 1¾ inches (forty-four millimeters), the outside one of a diameter of seven inches (175 millimeters); they were 5-16 inch thick (eight millimeters). The outside tubes had to be closed as hermetically as possible. This is of great importance, any leak of the cold brine mushing the ground around the tube instead of freezing it.



CLOSING OF PIPES AT BOTTOM AS FIRST TRIED.

This plugging was first done by means of lead plugs bearing on a conical sleeve, soldered to the inside surface

of the exterior tube. On this plug was placed a layer of cement; then one of plaster; then again one of cement; and over all, an iron disc. The tubes were first lowered and *plugged in place*, but they showed many leaks. They were then plugged *before* being lowered, a larger pipe, larger than the outside pipe of the circulating tubes, having been first driven in the ground, as was done later at the Chapin mine.

After several trials Mr. Poetsch has adopted the following manner of closing the tubes: He has replaced and does replace the conical sleeve of iron soldered to the tube by a cylinder of oiled pasteboard, 3/8 inch to 5/8 inch thick (ten to fifteen millimeters), and about ten inches long (250 millimeters), which is lowered to the end of the tube, into which is then forced the lead plug. This method allows of a better fitting of the lead plug in the pipe, and insures the tightness of the joint. The joints thus made in Europe appear to have been perfectly water tight.

The circulating tubes were connected in some similar manner to that described by Mr. Moran, and provided with proper regulating valve. The circulating liquid-cooled by the action of the machine, which at the Elmira mine was a machine of the Carré type (ammonia absorption machine), was a strong solution of chloride of calcium marking 28° at the Baumé areometer. We give below a table of the temperatures observed in the liquid at the inlet and outlet in the circulating pipes, as observed every five days, from the beginning of the work to the completion of the shaft:

DATES.	Temperature of the liquid in pipes at the return to the ice machine.		Temperature of the liquid in pipes as it leaves the ice machine.	
	Cent.	Fahr.	Cent.	Fahr.
June 29	—10.5	13.	— 9.	15.8
July 1	—12.5	9.5	—10.	14.0
July 5	—13.0	8.6	—10.	14.0
July 10	—12.0	10.4	—10.	14 0
July 15	—13.0	8.6	—10.	14.0
July 20	—14.0	6.8	—11.	12.2
July 25	—16.0	3.2	—10.	14.0
July 30	—14.0	6.8	—11.	12.2
Aug. 5	—14.0	6.8	—12.	10.4
Aug. 10	—13.0	8.6	—12.	10.4
Aug. 15	—13.0	8.6	—11.5	11.3
Aug. 20, beginning of sinking of shaft	— 14.0	6.8	—12.5	9.5
Aug. 25	—15.5	4.1	—13.5	7.7
Aug. 30	—15.5	4.1	—13.0	8.6
Sept. 5	—14.0	6.8	—12.0	10.4
Sept. 10	—15.0	5.0	—13.0	8.6
Sept. 15	—15.0	5.0	—13.0	8.6
Sept. 20	—14.0	6.8	—12.5	9.5
Sept. 25	—14.0	6.8	—12.0	10.4
Sept. 30	—14.0	6.8	—10.0	14.0
Oct. 5	—15.0	5.0	—14.0	6.8
Oct. 10	—17.0	0.8	—14.5	5.9
Oct. 15	—17.0	0.8	—15.0	5.0
Oct. 20	—16.0	3.2	—13.5	7.7
Oct. 25	—17.0	0.8	—15.0	5.0
Oct. 30	—18.0	0.4	—17.0	1.4

Mr. Poetsch at first approximation estimates the time of congealing by a very simple calculation. Knowing the cubic contents of the mass he intends to congeal, and its weight, and the amount of pounds of ice at which the capacity of the machine is rated and guaranteed to produce, a simple division gives him the time required to freeze sufficiently the ground to begin the operation of sinking the shaft through the frozen mass. There are of course many causes of errors in this manner of calculating, as many unknown factors intervene to vitiate such results; but as they are intended merely for a gross approximation, it may be said that the causes of error to some extent compensate themselves. On the one hand, there is more ground really frozen than actually estimated to be necessary for the work to proceed; and, on the other hand, the quicksand or the ground in general is estimated in the calculation as so much water, of which the latent heat of congelation is known; while the ground consists really but of a part of water. We refer to the article of Mr. Moran as to proportions of water and sand observed in the aquiferous sands at the Chapin mine from actual experiments.

(TO BE CONTINUED.)

[*Written for* ICE AND REFRIGERATION.]

SPECIFIC HEAT OF VARIOUS PRODUCTS.*

A CALCULATION OF THE SPECIFIC HEAT OF FOOD PRODUCTS—SPECIFIC HEAT OF SALT SOLUTIONS AND OF PROVISIONS, WITH COMPARATIVE TABLES.

BY PROF. J. E. SIEBEL.

In the application of cold storage and similar operations, the question as to the specific heat of many articles of food and drink frequently arises; also the amount of heat to be abstracted from such articles, in order to chill or freeze them, is often an important item. Thus far this subject is not covered by any experimental researches on record; and in order to supply this deficiency in some measure, I have tried to arrive at at least approximate values for these quantities by calculating them from the chemical composition of the substances in question.

The calculations here referred to are based on the assumption that the specific heat of substances which, like meat, eggs, vegetables, etc., are largely composed of water, is equal to the sum of the specific heat of this substance and that of the solid matter in combination therewith. This rule, with slight modification, applies to solutions of salt and other chemicals in water; and there is no reason why it should not answer in the case of the articles under consideration.

In the case of a solution of common salt, the specific heat varies with the concentration of the solution, as shown in the accompanying table:

Percentage of salt by weight.	Percentage of water by weight.	Specific heat observed.	Specific heat calculated.
0	100	1.000	1.000
1	99	0.992	0.992
5	95	0.960	0.961
10	90	0.892	0.922
15	85	0.855	0.883
20	80	0.829	0.844
25	75	0.783	0.805

The figures in the last column I obtained by adding the specific heats of water and salt; and by comparing them with the figures in the third column, showing the specific heat as found by actual observation, it will be seen that the latter figures are actually even smaller than the sum of the specific heats of the constituents of the solution.

In the case of solutions of salt and other chemicals such a reduction or contraction in the specific heat may be explained on the basis of a chemical change taking place between the salt and the water, which is also evidenced by the actual absorption of heat which we observe at the time the solution is made.

* This article was laid over from March issue and the answer given by us to questions of G. T. B. in that issue was based in part on the above article.

In the case of the provisions mentioned above, it is not likely that such a contraction takes place, since most of the solid matter exists in those articles side by side with the water without being in any kind of combination with the same. At any rate, it is safe to say that the specific heat of these articles will in no case be greater than the sum of the specific heats of the water and of the solid substances which they contain. On the other hand, it cannot be much smaller; for it cannot be smaller than that of the water contained in these substances, and that of the solid matter being very small, does not much change the figure to which it is added.

Following I give a table prepared by me, showing the composition of some of the most common dietary articles, from which their specific heat above and below freezing, as well as their latent heat of solidification, may be approximately derived, as it is done in the three last columns of table:

	Water.	Solids.	Analyst.	Specific heat above freezing calc.	Specific heat below freezing calc.	Latent heat of freezing calc.
Lean beef.	72.00	28.00	Pavy	0.77	0.41	102
Fat beef...	51.00	49.00	"	0.60	0.34	72
Veal.....	63.00	37.00	"	0.70	0.39	90
Fat pork..	39.00	61.00	"	0.51	0.30	55
Eggs.....	70.00	30.00	"	0.76	0.40	100
Potato....	74.00	26.00	Payen	0.80	0.42	105
Cabbage..	91.00	9.00	Letheley	0.93	0.48	129
Carrots...	83.00	17.00	"	0.87	0.45	118
Cream....	59.25	30.75	Muller	0.68	0.38	84
Milk.....	87.50	12.50	"	0.90	0.47	124
Oyster....	80.38	19.62	Payen	0.84	0.44	114
Whitefish..	78.00	22.00	Pavy	0.82	0.43	111
Eels.....	62.07	37.93	Payen	0.69	0.38	88
Lobster...	76.62	23.38	"	0.81	0.42	108
Pigeon....	72.40	27.60	Scamell	0.78	0.41	102
Chicken...	73.70	26.30	"	0.80	0.42	105

The specific heats in the fifth column of this table I calculated by the above mentioned rule, which reduced to an algebraic expression may be written

$$s = \frac{a + 0.2\,b}{100} = 0.008\,a + 0.20$$

in which formula s signifies the specific heat of a substance containing "a" per cent of water and "b" per cent of solid matter; 0.2 is the value which has been uniformly assumed to represent the specific heat of the solid constituents of the different articles in question. These, as well as the rest of the figures, have been rounded off to two decimals. If the articles are cooled below freezing, which takes place below 32° F., the specific heat changes, owing to the fact that the specific heat of frozen water is only about half of that of liquid water. In conformity with this fact and considering that the specific heat of the solid matter is not apt to change under these circumstances, we find the specific heat s' of the same articles in a frozen condition after the following formula:

$$s' = \frac{0.5\,a + 0.26}{100} = 0.003\,a + 0.20$$

and in this way I have obtained the figures in the sixth column of the above table.

The figures in the last column, showing the latent heat of freezing, have been obtained by multiplying the latent heat of freezing water, which is 142 B. T. U. by the percentage of water contained in the different materials considered. This course, it is thought, needs no further justification, since only the liquid or watery portion of these materials is concerned in the solidification or freezing of them, while the solid constituents remain in their original condition. After these rules and examples it will be a simple matter for any one to calculate the specific heat, etc., for other similar articles by simply knowing the percentage of moisture which they contain.

The specific heat of beer wort, which is also an item of some use in practical refrigeration, may be calculated after the same rule. As the solids therein, however, are chiefly of a saccharine nature, their specific heat should be figured in with about 0.3. In this way we find the specific heat of beer wort of different strengths expressed in percentage of solids or degrees Balling as follows:

Strength of wort. Deg. of Balling.	Specific heat.
8	.944
9	.937
10	.930
11	.923
12	.916
13	.909
14	.902
15	.895
16	.888
17	.881
18	.874
19	.867
20	.861

The specific heat of beer may also be found after the same rule from its chief component parts of extract, alcohol and water, taking in consideration that the specific heat of the extract portion is about 0.3, while that of the alcohol is about 0.65. Then if a be the percentage of alcohol and b be the percentage of extract contained in a beer, its specific heat s would be very nearly

$$s = \frac{100 - 0.7\,b - 0.35\,a}{100}$$

Taking as an instance a beer containing 4 per cent alcohol and 6 per cent of extract, its specific heat would be 0.944.

THE latest "curious change in business" affected by "cold storage," is the "muzzled oyster." A clamp, we are heartlessly informed, "has been invented which holds the shell of his bivalveship together and, beyond thinking, he has no chance for amusement or death, being hermetically sealed. In this fashion he is shipped to India and all sorts of queer places." Thus does the octopus of science reach forth its tentacles; and not content with consigning the stolid and sedate mussel to the lonely fate of decorating a church festival stew, doth now deliver him, with "all his perfections in his shell," over to the untender mercies of the emigrated "royal beef eaters" of the antipodes. He might nurse his revenge were he assured that the mouths he fills at antipodean banquets would be similarly muzzled after the feast, nor would he then have lived in vain.

THE ice expert of *Frank Leslie's Weekly* informs the readers of that paper that, "Snow ice is the most desirable, it having more durability than the clear ice, and consequently is most sought after for use in refrigerators," etc. This is new, certainly. We wonder how many superintendents are now "kicking themselves" around the back lot for wasting time and money removing the snow so as to get clear ice only!

MR. JOHN E. STARR having been ill, the continuation of his article on "Absorption Machines" is laid over until the May issue.

ABOUT PRICES.

THE OUTLOOK AT THIS TIME—CONDITION OF THE ALBANY ICE ASSOCIATION—THE INDIANAPOLIS CASE—THE APPROACHING WAR AT NASHVILLE, TENN.—THE FIGHT ON THE PACIFIC COAST—PRICES, ETC.



AS STATED in the March issue of ICE AND REFRIGERATION, the outlook in the retail ice trade is decidedly "bearish"; and from present indications in several localities, if they are thought to be indicative of the temper of the trade generally, it would seem that only exceptional self-control will prevent a bad demoralization of the business during the coming retail season. The cause at the bottom of the unrest is undoubtedly the abundance of ice in store; but while naturally some reduction in price might be expected to obtain later on, there seems no valid reason why the cutting and "mutterings of war" should begin as early as the first week in March, when the character and length of the retail season cannot be more than guessed at. The advice to "Go slow!" will avail but little where hostilities have already broken out; but it is fair to suggest at this time, that wars are costly ventures for both sides engaged, to be avoided always when possible, especially when, as at this present must be the case, the *causus belli* cannot be other than an indefinable and indefinite substance at best.

The recently organized Albany Ice Association at Albany, N. Y., already shows signs of dissolution. It has been vigorously attacked as a "trust" by the local press, of course; but its chief enemies appear to be its own members. It was originally composed of all the retail dealers in the city, among whom the territory was divided, with a view to lessening the expenses of delivery by doing away with the practice of having the wagons of all dealers traveling over the same territory. The arrangement promised to be an economical one, as it must of necessity have reduced the number of wagons and the expense of maintaining active rolling stock. On the 10th ult., however, the announcement was made that R. B. Rock & Son and Shefferdecker Bros. had withdrawn from the Association, their disaffection threatening it with total disruption. Mr. Rock says the cause of his dissatisfaction lies in the fact that some of the members have not lived up to their agreement to deliver ice from running streams or lakes only; *i.e.*, the best ice in store. The price to be asked of large consumers by the association, he said, was to be $2 per ton. The price to smaller consumers had not been fixed. He said the ice furnished by most of the dealers was from the river and canal, and was muddy, while his, coming from Ballston lake, was clear, and cost him between $1 and $2 to house, while canal and river ice did not cost more than twenty cents. When questioned as to the probable price of ice to families this summer, Mr. Rock said: "That all depends on the quality of the ice. Some dealers will charge thirty to thirty-five cents, while those who have brought ice from the lakes, where the cost of housing is much larger, will charge forty cents per week." Concluding the interview, the reporter sums up the situation by adding: "And the probability is that when the combine is once well busted, and the members begin sawing at one another's throats, the price will go down to twenty-five cents a week." The Association has been re-organized by the members left after the above-named withdrawals.

There was a "war cloud" in sight at Indianapolis, the contestants being the natural ice men on the one side, and the manufactured ice on the other. Last season the natural article being scarce and of rather inferior quality, the machine ice men succeeded in getting the lion's share of the family and hotel table trade, which this year, it was published, the natural ice dealers, with an abundance of ice on hand, would endeavor to regain. Last year, to private consumers, both the machine and natural ice dealers charged forty cents per cwt., but this year, says a local paper, it was believed that prices would break until natural ice would be furnished at least as low as twenty-five cents per cwt. Such a row, of course, could only be destructive to both sides; but a cooler judgment prevailed, and having cast up the situation and finding they had no ice to "fool away," the dealers have fixed a minimum price of thirty cents per cwt., to private families.

At Nashville, Tenn., the struggle is already on, having begun about March 1; and the ruling price, March 8, to large and small consumers was twenty-five cents per cwt., delivered, or twenty cents per cwt. at the factory. Before the first of this year the price to small consumers was fifty cents per cwt., and to large consumers thirty-five to forty-five cents.

The reduction in price is properly attributable, says the *Herald*, to the organization of the Consumers' Ice, Coal and Cold Storage Co., which is erecting its plant in East Nashville, B. F. Parker, formerly of the firm of Howe & Parker, being the leading spirit of the new company. The latter is composed chiefly of the larger consumers of ice, including among its stockholders all the principal hotels except one, who will take their dividend in reduced cost of ice, the net price to these shareholders being twenty-five cents for the largest consumers, and thirty-five cents for those not so large. The new factory is not yet in operation, but for some time past it has been furnishing Louisville ice to its customers. About the first of the year, when the new company was organized, and before it began to sell ice, the other factories cut the price on ice to thirty-five cents to general consumers, and twenty-five cents to large consumers; and about the 1st ult. all the factories in actual operation cut the price to twenty-five cents delivered and twenty cents at the factory, to all consumers; while the new company sold Louisville ice to general consumers at thirty cents per cwt.

As the friends and admirers of the Hon. John L. Sullivan might remark, there is a "most illigant set-to" in progress on the Pacific coast, which promises to make ice cheaper on the coast than it has ever been known there. For the past twenty-five years the harvest and sale of ice on the entire coast have been practically controlled by the Union Ice Co. Backed by the Southern and Central Pacific railroad corporations, the Union has been able to drive nearly all competitors to the wall by

exorbitant freight rates on ice or ice making machinery, or to ruin them by merciless cuts in prices, while those who survived these trials were quietly bought out and extinguished. Rates to wholesale consumers in 'Frisco had been $10, $15 and $20 a ton, which were common prices for years; and proportionately high prices were charged small private consumers. The first successful competitor of the Union in the city was the Consumers' Ice Co., of which Mr. Sneath is at the head—a company organized by the light of a dark lantern, its stockholders fearing that if their intentions became known their ice supplies would be cut off by the Union before their Blymyer machine could be put in operation! The Consumers' company having proved a successful competitor, the Union consequently "recognized" the ice machines, and has since absorbed some minor companies using them. The competition of the Consumers' company, however, seems to have acted as a tonic on the Coast, and about the first of February a new company was organized, called the National Ice Co., with headquarters at 327 Market street, San Francisco. This company is composed of a number of disaffected stockholders of the Union, the Consumers' Ice Co., the Merchants' Refrigerating Co., the Cold Storage Co., San Francisco; the Los Angeles Ice Co., the Nevada Ice Co., the Mountain Ice Co. (of Truckee, formerly a part of the Union), and the Floriston Ice Co., of Truckee. This combination leaves as the Union's allies the Sierra Lakes and the People's—both with houses on the Truckee river—and various other minor companies, and some machines scattered over the coast; while the Tahoe Ice Co. of Truckee, belonging to neither, sells its ice to the Union.

The new National has an abundance of capital, and has started out to get business at every important point of consumption on the coast. Just what source of supply of natural ice the National has aside from the houses of the allied Truckee companies is not apparent, but it has the Consumers' in San Francisco, and the ice factory in Los Angeles, and has built another at Riverside, which is now about ready to make ice.

The cut in the rates began about March 1, when the National began business. The Union's rate prior to March 1 was $7 a ton at wholesale; a few days later the price became $6.50; then $5 a ton, with the Consumers' (National), it is said, making contracts at even a less rate. In short, the fight will be conducted to a "finish"; and so far as the trade generally is concerned, the struggle is interesting from the fact that if the National succeeds, the ice business on the Coast, for the first time in a quarter of a century, ought to become a free business, open to any one who desires to enter it.

Mr. Dunn, in reporting prices at Burlington, Iowa, says: "It has never been customary here to grade prices for small deliveries, such as ten and twenty pounds, each dealer or driver making his own price.

"I am not prepared to give you selling prices at any other points in Iowa, but I think they will not vary much from those given above.

"The supply of ice put up at any of the Mississippi river points the past winter was quite limited, owing to the shortness of the season for cutting, until a distance is reached some 200 miles north from this place; but enough was packed for home use, with very little for shipping purposes. One small lot of 2,000 tons was sold here a few days ago to St. Louis parties for $1.50, and another similar quantity is offered at the same price. The B., C. R. & N. railroad carried very little ice—200 or 300 cars—over its road the past winter, against several times that quantity the previous winter, owing doubtless to the great increase in the number of refrigerating plants in the territory hitherto supplied with northern ice."

The letter of the St. Louis Automatic Refrigerating Co. (pipe line) is interesting. Mr. Starr, secretary, writes: "We sell the power of ammonia to take up heat, our unit being the pound of NH_3. As yet we do not sell this by meter, but make a special contract to refrigerate each box, or to cool each room, or to supply so many taps with ice water, etc., taking into consideration special conditions in each case. At this date we pay very little attention to the market price of ice, as within reasonable limits it is no longer a competitor wherever we have our mains. The consumer figures about the same as he would figure on lighting if the competition lay between kerosene oil and gas or electricity."

The Kansas City Ice and Cold Storage Co. write that they are wholesalers of ice only, contracting for their entire production. As to retail prices and generally, they add: "Retail prices here during the coming season will run from fifty cents to $1, according to the amount of ice consumed. There will be little variation from the past season of 1891, which proved a most unprofitable one in this town for the ice dealers. There has been a good deal more ice cut here this year than last, but you are wrong in your March number in stating that all the ice houses are full. This is by no means the case, and a lot of the ice that has been put up here is hardly worth storing, most of it being specked and thin, averaging, we suppose, about eight or nine inches. We should be glad at any time to give you any information we can, as we think your publication is a very valuable one, and deserving the support of every ice dealer and cold storage house in the country."

UNTABULATED PRICES REPORTED.

——The Paducah (Ky.) Ice Co. say that prices for this year will not be fixed until May 1.

——A. S. Patten & Co., Binghamton, N. Y.: Wholesale, 15c. to 20c. per cwt.; retail, 35c. to 50c. per cwt.

——Ryan & Richardson, ice manufacturers, Leavenworth, Kan., wholesale only; at $2.50 per ton at the factory.

——Reading (Pa.) Ice Manufacturing Co.: Retail, $6 per ton or 30c. per cwt. Wholesale, $2.50 per ton at the plant.

——Howe Ice Co., Nashville, Tenn: One delivery—5 lbs., 5c.; 20 lbs., 10c.; 35 lbs., 15c.; 50 lbs., 20c., 100 lbs., 35c.

——Arctic Ice Co., Indianapolis, manufactured ice: Private families, not less than 25 lbs. in one delivery, 35c. per cwt.

——S. D. Lount & Son, Phœnix, Arizona: Under 50 lb., 1 c. per lb.; 50 to 1,000 lb., ¾ c. lb.; over 1,000 lb., ½ c. lb. at factory.

——Cochran-Oler Ice Co., Baltimore, report: "The ice dealers here have not taken any action regarding prices for the season of 1892."

——Hagerstown (Md.) Ice Co. prices: Private families, 50c. per cwt.; confectioners, hotels, saloons, etc., 25c. per cwt.; car load lots, $3.50 per ton.

——A. C. Jones, Valley Ice Co., reports rates at Hot Springs, Ark., as follows: 500-lb. tickets, $5; 2,000-lb. ticket, $15; wholesale in car load lots, $6 per ton.

——Tennessee Ice and Cold Storage Co., Jackson, Tenn.: Car load lots, $5 per ton; 100 lbs., sacked, 50c.; retail—5 to 20-lb., 1c. per lb.; 21 to 49-lb., ¾ c.; 50 to 100-lb., ½ c.

——The Crescent City Ice Co., New Orleans, report: "All manner of prices here at present; $4 to $5 by the ton; small trade supplied at about one-half cent per pound."

——The Arctic Ice and Cold Storage Co., Buffalo: Family rates (see table), daily deliveries per week, 30 lb., 67c.; 40 lb., 85c.; 50 lb., $1; double weights Saturday, extra ice at 30c. per cwt.

——The New Orleans Ice Manufacturing Co. quote market prices in that city as follows: Contracting in general, $4 per ton (one contract made as low as $3.90); retail delivery, 22½c. to 25c. per cwt.: platform price, 20c. per cwt.

——The Griesedieck Artificial Ice Co., St. Louis, say: "Our prices for ice during the month of March are $3 per ton, with a probable advance for April. Have not yet decided what our summer rates will be. We do not retail."

——Artificial Ice and Cold Storage Co., Canton, Ohio (see table): For family trade coupon books are issued, containing 80 50-lb. tickets, making 400 lb., and sold to the drivers at $2, who sell them to the trade at cost to them or stand the loss.

——Dallas Ice Factory and Cold Storage Co., Dallas, Tex.: Wholesale—car lots f. o. b., $4 per ton; ton lots f. o. b., $5 per ton; ½-ton lots, f. o. b., $6 per ton. Retail—100 bbs., 40c.; 75 lb., 35c.; 50 lb., 25c.; 25 lb., 15c.; 15 lb., 10c.; 10 lb., 5c.

——Prices at Pensacola adopted by the local dealers, in addition to wholesale rates quoted in the table are: Private families, restaurants, etc., 60c. per cwt.; deliveries of 50 lbs., 35c.; of 25 lbs., 20c; under 20 lbs. 1c. per lb.; 205-lb. tickets, $1; 10 10-lb. tickets, $1; car loads of 12 tons, $6 per ton f. o. b., cash or draft with b. l.

——Chicago prices, as the Washington Ice Co. and Jas. P. Smith & Co. report, have not been agreed upon for the season. Jas. P. Smith & Co. say: "The market price of ice, wholesale or retail, is in an unsettled state, supply and demand governing to a great extent. Wholesale car loads sell for $1.15 to $1.30 per ton, according to quality of ice. Retail ice, $2 to $2.50 per ton, according to amount. Family trade 20c. to 35c. per hundredweight. The prices are very low."

——The Grand Rapids, Mich., Ice Dealers' Association, comprising six firms, have agreed on rates for 1892 as follows, which are very moderate, certainly: Hotels, restaurants, etc., monthly consumption, 4,000 lbs. or over, 15c. per cwt.; 1,500 to 4,000 lbs., 20c. per cwt.; 700 to 1,500 lbs., 25c. per cwt.; family rates per week—20 lbs. daily, 40c.; 25 lbs., 45c.; 30 lbs., 50c.; 20 lbs., three

TABULATION OF CURRENT PRICES FOR ICE AT WHOLESALE, ALSO FAMILY AND RETAIL POUND RATES IN VARIOUS CITIES OF THE UNITED STATES.

CITIES AND DEALERS.	WHOLESALE.					RETAIL TO FAMILIES, ETC.											POUND RATES.					
	Per ton, delivered.	Per ton at house or factory or cars.	Butchers, per cwt.	Saloons, etc., per cwt.	Large lots, per cwt.	5 lbs. per month.		10 lbs. per month.		15 lbs. per month.		20 lbs. per month.		25 lbs. per month.		Offices six times per week.	25 lbs. or less, per cwt.	50 lbs. or less, per cwt.	50 lbs. and over, per cwt.	100 lbs., per cwt.	500 lbs., per cwt.	1,000 lbs., per cwt.
						Daily.	Four times week.	Daily.	Four times week.	Daily.	Four times week.	Daily.	Four times week.	Daily.	Four times week.							
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Heidt & Lerch, Davenport, Iowa (1)		2.00	12½@15	.20	.12½			1.50		1.75		2.00				1.25						
Howe Ice Co., Nashville, Tenn.					.30																	
Arctic Ice Co., Indianapolis, Ind	3@3.50			.20																		
Detweiler Ice Co., Peoria, Ill. (2)		3.00	.20@.25	.20@.25				2.00	1.25	2.50		3.00		3.75		1.75						
Pure Ice and C. S. Co., Springfield, Ill.	6.00	4.00	.40	.40	.40	1.50		2.50	2.40	3.25	3.00	3.75	3.25	4.00	3.70							
Diamond Ice Co., Wilmington, Del. (3)						1.40		1.90		2.52		3.36										
B. C. Ice, C. & C. S. Co., Ft. Smith, Ark. (4)	10@12	5@6.50	.65	.65	.65													1.00	.75			
M. Dunn, Burlington, Iowa	4.00																	.50		.40	30@.35	.25
Dist. W. Ice Co., Cairo, Ill.																	40@.60			.35	.30	
Champion Ice Co., Covington, Ky.																	.50		.40	.30	.25	.20
Dist. W. Ice & C. S. Co., Pueblo, Colo. (5)			.25	.25				2.00														
B. G. Ice Co., Bowling Green, Ky. (6)		5.00															1.00	.80	.60	.50	.40	.40
Jack. Ref. Ice Wks., Jacksonville, Fla.			.30	.35@.40																		
Car. Ice and C. S. Co., Carthage, Mo.	5.50	5.00	.50	.50		1.50		2.75		4.00		5.00		6.00								
Sp. Coal and Ice Co., Springfield, Ohio.	4.00		.30	.30	.25													.60	.40			
Nat. Ice Co., Natchez, Miss. (7)	8.00		.50	.50																		
Stratton Ice Works, Pensacola, Fla.	9.00		.50@.60	.50@.60																		
Gorrie Ice Co., Savannah, Ga. (8)																	.40	.32	.30	.25		
R. Ice Mfg. Co., Rome, Ga																	.50	.50	.50	.40	.35	
Washington Ice Co., Chicago (9)										2.40	2.00	2.80		3.20					.35	.35	.20	17½
Mich. Lake Ice Co., Toledo, Ohio (10)	3@4.00		.15	.20@.25	.15@.25													.40		.30	.25	.20
Bemustown Ice Co., Meadville, Pa.	4.00							1.50		2.00		2.50		3.00					.35			
An-Busch Brg. Assn., Springfield, Mo.		3.00																.75	.60	.40		
Wis. Lakes Ice Co., Milwaukee, Wis.			.20	.30	.10@.20							2.00				2.00					.20	12½
Dayton Ice Mfg. Co., Dayton, Ohio			.15	.20													.40		.30	.25	.20	.20
Wheeling, W. Va		3.00	.30@.35	.30@.35																		
B. Cooper & Co., Troy, N. Y.					.15							1.40	1.00			1.20						
Art. Ice and C.S. Co., Canton, Ohio.			.20	.25																		
Arctic Ice and C. S. Co., Buffalo, N.Y. (11)	3.00	2.00											2.00							.15	.10	.10

(1) Say that prices are at the bottom, with a new dealer in the field cutting to 10c. to 20c. per hundredweight to any kind of trade. Prices are ten cents lower than last year. No old ice carried over this winter. Lots of more than 20 pounds daily, 30c. per hundredweight put in refrigerator free: putting in refrigerator, 25c. per month.

(2) Thirty pounds daily $3.75. Per hundredweight: 40 to 100 pounds daily, 35c.; 100 to 300 pounds, 30c. At ice house, small lots, 20c. per hundredweight. By car load, $1.50 to $1.75. Extra ice to be paid for on delivery.

(3) Nominal rates as per 1890 and 1891. It is probable when rates are fixed for 1892, they will be slightly higher than the rates quoted. Pound rates: 25 pounds and over, at 50c. per hundredweight.

(4) Car load lots, $3 to $6 per ton.

(5) Large private consumers, 50c. per hundredweight; natural ice, $1 to $1.50 per ton less than manufactured ice. Both kinds handled.

(6) By express, packed, 70c. per hundredweight.

(7) To private families, 60c. per hundredweight; at factory, 50c. per hundredweight; packed for shipping, 75c. per hundredweight.

(8) Retail at factory, 15c. per hundredweight. These prices are a cut from last year, and are met by other dealers. Being very low they are not likely to remain unchanged, we are informed.

(9) Last year's prices temporarily, the rate being by week, one-fourth of price quoted in family rate columns. By wagon load, 15c. per cwt.

(10) Not definitely agreed upon, but the probable ruling prices, put in box.

(11) Pound rates as quoted are prices at the factory, not delivered.

——At Nashville, Tenn., the Howe Ice Co. announce rates for deliveries of 100 lbs., 25c.; 50 lbs., 15c.; 25 lbs., 10c.; 10 lbs., 5c. The unsettled condition of prices there, however, places these quotations in the column of "nominal" rates, however.

——B. Cooper & Co., Troy, N. Y., (see table): Families at 20c. per cwt. They say: "The situation demanded an increase in these prices this season, but the business jealousy, etc., that prevails among ice dealers in all sections has full sway here, and prevented it."

——Dayton (Ohio) Ice Manufacturing Co. (see table) add: Car load lots, $1.50 per ton at this time; but as the season advances and the demand is greater, it increases; but we do not expect it to go over $2 per ton, owing to the vast amount secured by the natural ice men.

——St. Augustine (Fla.) Ice Works quote prices: Retail, 6 lbs. daily, $1.50 per month: 12 lb. $3; 25 to 100 lbs., 60c. per cwt.; 100 lb. and over, 50c.; no accounts to be less than $1.50 per month. Wholesale—100 to 200 lbs., 50c. per cwt.; 200 to 2,000 lbs., 40c.; 2,000 lbs. and over, $7 per ton; special rates on large quantities.

times per week, 25c.; 10c. per week extra for placing in box; pound rates—under 700 lbs. per cwt., 40c.; 700 to 1,500 lbs., 25c.

——Wisconsin Lakes Ice Co., Milwaukee (see table): Family trade, 20 lbs. daily delivery, $20 per year; office use, 20 lb. daily, $18 per year; extra ice, 20 to 150 lbs., one delivery, 30c. per cwt.; 150 to 1,000 lbs., 20c.; 1,000 to 5,000 lbs., 12½c.; 5,000 lbs. and over, 10c.; at house or car, 10c.; 40 lbs. daily, $3 per month. Coupon books sold for less quantities than daily deliveries of 20 and 40 lbs., rates made at office. M. J. Haisler, president, writes: "These are last year's prices, at which we propose to sell this year. We have considerable competition here in the trade, and I would be surprised if some of our competitors did not cut prices this season."

——The Wheeling Ice and Cold Storage Co. write: "Our wholesale price to dealers is $3 per ton. Their rates to consumers has been arranged as follows: To hotels, butchers, drug stores, restaurants and saloons, trade such as take from 200 to 500 lbs. and upward, 30c. to 35c. per cwt.; to family trade 50c. to 60c. per cwt. These prices we consider reasonable, considering the very limited amount of natural ice harvested in this

locality. There was but a small crop of three to five-inch ice cut from ponds and small streams, fit only for cooling purposes, the quality being very poor."

——The Penobscot dealers have refused brokers' offers of $1 per ton for the stock housed, and are holding out for $1.25 to $1.75 per ton, which they expect to get.

——We are indebted to the Arctic Ice Co., Allegheny, Pa., for prices in Pittsburgh and Allegheny, the rates of all companies being uniform. The lists are as follows:

WHOLESALE PRICE LIST.

Lbs. consumed per week.	Per Cwt.	Lbs. consumed per week.	Per Cwt.
700 to 1,000	35c.	2,000 to 2,800	25c.
1,000 to 1,400	30c.	2,800 to 4,000	23c.
1,400 to 2,000	28c.	4,000 and over	20c.

RETAIL PRICE LIST.

10 lbs. 6 deliveries	$ .48	per week	
15 " 6 "	.66	"	
20 " 6 "	.84	"	
25 " 6 "	1.02	"	
30 " 6 "	1.14	"	
35 " 6 "	1.26	"	
40 " 6 "	1.38	"	
50 lbs. twice per week,	.63	"	
50 lbs. 3 times per wk.	.93	"	
10 lbs. 7 deliveries	$ .56	per week	
15 " 7 "	.77	"	
20 " 7 "	.98	"	
25 " 7 "	1.19	"	
30 " 7 "	1.33	"	
35 " 7 "	1.47	"	
40 " 7 "	1.91	"	
100 lbs. twice per week,	1.00	"	
100 " 3 times per wk.,	1.35	"	
100 " 4 " " "	1.60	"	

——The Michigan Lake Ice Co., Toledo, Ohio, after quoting (see table) the probable rates which will be agreed upon by the dealers of that city, says: "Ice at wholesale or f. o. b. here for shipment is worth $1.50 per ton, with the usual allowance of one ton per car for shrinkage and cores. A large quantity of Michigan lake ice is used in this market, which is valued at $1 per ton f. o. b. at point of shipment. These prices are based on contracts for stipulated quantity and regular shipments. Scattering and irregular orders are more expensive to handle, unless circumstances happen to be favorable for them when they are received, and the price is regulated accordingly. The old plan of serving customers with ice by the month has been abolished, and the weight method adopted. The one was substituted for the other three years ago, at which time we commenced using a coupon ticket system, an invention of our own. This system has proven to be a very useful one, and the dealers are all using tickets at the present time."

——The Jacksonville, Fla., Refrigerator Ice Works, in addition to terms quoted in the table, continue this season their coupon book system for the family trade—a modification of the ticket system. We reprint their price list this season for the benefit of those who are not familiar with it:

Pounds in Book.	Number of Coupons.	Pounds each Coupon.	Letter of Book.	Price of Book.	Price each Delivery.	Price of same amount of ice cash from carts.
500	10	50	A	$2.50	25c.	30c.
520	13	40	B	2.75	21c.	25c.
500	20	25	C	3.00	15c.	20c.
500	25	20	D	3.25	13c.	15c.
500	50	10	E	3.75	7½c.	10c.
250	50	5	F	2.25	4½c.	5c.
500	5 / 10	50 / 25	G	2.75	Same as above.	
300	20 / 20	10 / 5	H	2.40	Same as above.	
125	9 / 8	5 / 10	I	1.00	Same as above.	
115	23	5	J	1.00	Same as above.	

——The Krueger Hygienic Ice Co. (manufacturers), Newark' N. J., write: "The prices for ice last season were as follows: Independent ice dealers, $2 per ton at the factory; to the general trade, when one block (300 lbs.) was purchased at one time it was $3 per ton; and when less than one block was sold at one time, the price was $4 per ton. The outlook for this summer is about as follows: The natural ice companies have conceded that the 'artificial ice' has come to stay, and they are anxious to compromise on a price for the coming season by charging the independent ice dealers $2.50 per ton; and at the 'Bridge' the prices to remain about the same as last year—the street price to be not less than 25c. per cwt. to butchers, saloons, etc., and to families 50c. per cwt. There are about seventy ice wagons employed in delivering ice during the summer months, one-half of which are 'independent ice dealers,' who purchase ice from the larger companies, twenty-five of these dealers purchasing their supplies from the Krueger Hygienic Ice Co., who run no wagons. The New York City Ice Co., the oldest established ice company in New York, and the Knickerbocker Ice Co. have no 'independent' ice dealers trading with them, whereas a few years ago about one-half of them did purchase of these companies. The Yautacaw Ice Co. and the United Ice Lines do not run any ice wagons, but sell to the general trade, but the Yautacaw company serves about the balance of the independent dealers not served by the Krueger Hygienic Ice Co. All of the natural ice companies, with the exception of the United Ice Lines, get their ice from the Hudson river, the latter company getting their ice from Greenwood lake, Lake Hapatcong and Macopin lake."

NOTES ON PRICES.

——The price of ice has been increased twenty-five cents per cwt. at Albany, N. Y.

——Philadelphia dealers will have nothing to say of prices until the season is fairly open.

——The price of ice at Montreal will be the same retail as last year, but wholesale prices will be higher.

——Toledo dealers announce that last year's prices will probably rule this year; ice certainly will be no higher.

——David Sanderson, of Ottawa, Ill., will furnish Fox river ice to S. S. Harding, who will begin business at Streator, Ill.

——The Grant Ice Co. has been incorporated at Grand Rapids, Mich.; capital, $10,000; incorporators, Jas. Grant, Chas. C. Follmer, Kate L. Rogers.

——Windsor, Ont., Canada, will have two more companies in the trade this season, and the present outlook is for a general reduction from last year's rates.

——The Twin City Ice Co., of Moline, Ill., are making preparations to enter the field at both Moline and Rock Island, its near neighbor, the new company having obtained a foothold in the latter city by purchase.

——Speaking of the outlook for the ice demand this summer, a Maine gentleman who has been in the business for years, said that while two years ago he was willing to sell, this year he proposes to hold on for a while. He doesn't anticipate any great flurry, but a steady demand.

——The butchers and saloon keepers are said to have organized a combination at Lexington, Ky., to import lake ice should the Consolidated Ice Co. charge over forty cents per cwt. It is hinted by the local paper that in case the threat is carried out, the ice company will retaliate by storing imported meat in the cold storage rooms and open retail shops throughout the city.

——The Colorado Ice and Storage Co. put their new ticket system into operation March 1, the change having been preceded by a banquet which was attended by the officers, some stockholders and all of the employes of the company. This system was fully explained in the issue for March of ICE AND REFRIGERATION. At the banquet, in addition to a discussion of the new system it was announced that for the benefit of the employes, the company would on March 1 put into operation a system of insurance, which gives a man accidentally injured an indemnity of $5 a week, to run during his disablement up to a period of one year; in case of death he receives $100. There was also announced a system of reward, which is made up of five classes of $100, $50, $40, $30 and $20, which prizes are to be given to the five delivery men gaining the highest percentage of merit in the services of the company and in accommodations to its patrons.

REFRIGERATION AT THE WORLD'S FAIR.

The World's Columbian Exposition Co. has awarded to the Hercules Iron Works, of Chicago, the contract for the entire cold storage on the fair grounds. The building to be used for cold storage will contain not less than 600,000 cubic feet of space. In addition to this the company will every day cool to a temperature of 38° F. 30,000 gallons of Waukesha water for use on the grounds, and will manufacture from fifty to sixty tons of ice for the daily use of restaurant keepers and others. The total plant will have a refrigerating capacity of 300 tons of ice each twenty-four hours, and will be one of the finest ever built, costing in the neighborhood of $150,000.

This contract was awarded to the Hercules company only after the most thorough investigation by a special committee, as to the ability of the company to furnish a first-class plant in every respect, and as to their financial ability to carry through the undertaking. The committee reported unanimously that there was no question whatever on either of these points. This is a large amount of money to pay out for an exhibit, but the Hercules company undoubtedly know what they are doing, and they will be the gainers in the long run from the fine exhibit they will be able to make.

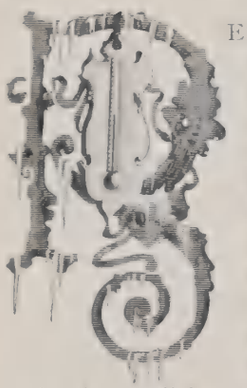
THE attention of the reader is called to the letter of Mr. Baker, of the Pure Ice and Cold Storage Co., Springfield, Ill., which will be found elsewhere under the heading of "Trade Correspondence." Comments are invited from the trade on the problem suggested, which, as operators of ice and refrigerating machines will see at a glance, is a very important one. We trust our readers will respond freely to this invitation, in order that some practical results may obtain from Mr. Baker's comunication.

[*Reprinted from "Nature."*]

LOW TEMPERATURES.

PROF. PICTET'S LABORATORY AT BERLIN—LOW TEMPERATURES OF —200 C. ARE PRODUCED—THEIR VALUE—CRYSTALLIZATION OF CHLOROFORM.

By R. Du Bois-Reymond.



RESEARCH purely scientific, it has often been remarked, frequently bears fruit of practical value. A fresh illustration of this fact is afforded by the work of Prof. Pictet, the eminent man of science, of Geneva, who is turning to practical account the apparatus by which, in 1877, he first reduced hydrogen and oxygen to the liquid state. At Berlin, where he now resides, he has established, on the scale of a small factory, what he terms a "*laboratoire a basses temperatures.*" The following account of the work carried on and the results obtained is taken from papers read by the professor before different scientific societies of Berlin.

The refrigerating machinery, driven by several powerful steam engines, is intended to withdraw heat from the objects under observation, and to keep them at any temperature between —20° and —200° C. as long as may be required. Prof. Pictet's experience has led him to the conclusion that among the refrigerating agents known, such as rarefaction of gases, dissolution of salts, evaporation of liquids, the latter is to be preferred. A long course of research has enabled him to choose the most convenient from among the great number of suitable liquids. In order to avoid the great pressure required in handling the highly evaporative substances of lowest boiling point which serve to produce extreme cold, it is necessary to divide the difference of temperature into several stages. Each stage is fitted with especial apparatus consisting of an air pump worked by steam, which drains off the vapors of the liquid from the refrigerator, and forces them into a condenser, whence, reduced to the liquid state, they are again offered for evaporation in the refrigerator. Thus the liquid, without any loss beyond leakage, passes through a continuous circuit, and the operations can be carried on for any length of time. The liquid made use of for the first stage is the mixture of sulphurous acid and a small percentage of carbonic acid called "*liquide Pictet.*" It is condensed at a pressure of about two atmospheres in a spiral tube merely cooled by running water. Oxide of nitrogen (laughing gas) is the liquid chosen for the second stage. Its vapors are condensed in the same way at a pressure about five or six times as great in a tube maintained at about —80° by the action of the first circuit. As medium for a third stage, in which, however, continuous circulation has not yet been attempted, atmospheric air is employed, which passes into the liquid state at a pressure of no more than about seventy-five atmospheres, provided the condenser is kept at —135° by the first two circuits. The evaporation of the liquefied air causes the thermometer to fall below —200°.

By this combination quite new conditions for investigating the properties of matter are realized. In various branches of science new and surprising facts have already been brought to light. Many laws and observations will have to be re-examined and altered with regard to changes at an extremely low temperature.

For instance, a remarkable difference was noted in the radiation of heat. Material considered a non-conductor of heat does not appear to affect much the passage of heat into a body cooled down to below —100°. Or, to state the fact, according to Prof. Pictet's view: "The slow oscillations of matter, which constitute the lowest degrees of heat, pass more readily through the obstruction of a so-called non-conductor than those corresponding to a higher temperature, just as the less intense undulations of the red light are better able to penetrate clouds of dust or vapor than those of the blue." If the natural rise of temperature in the refrigerator, starting from —135°, is noted in a tracing, and afterward the same refrigerator carefully packed in a covering of cotton wool of more than half a yard in thickness, and cooled down afresh, and the rise of temperature again marked, on comparing the tracings hardly any difference will be found in the two curves up to —100°, and only a very slight deviation even up to —50°. On this ground it is clear that the utmost limit of cold that can possibly be attained is not much lower than that reached in the famous experiment of liquefaction of hydrogen. The quantity of warmth which hourly floods a cylinder 1,250 mm. high by 210 mm. wide (the size of the refrigerator), at —80° is no less than 600 calories, and no packing will keep it out. At a lower temperature, the radiation being even greater, the power of the machinery intended to draw off still more heat would have to be enormous. And as —273° is absolute zero, the utmost Prof. Pictet judges to be attainable is about —255°.

As an example of the surprising methods which the refrigerating machine permits the investigator to employ, it may be mentioned that, in order to measure the elasticity of mercury, Prof. Paalzow had the metal cast into the shape of a tuning fork, and frozen hard enough for the purpose in view. On this occasion it appeared that quicksilver can be shown in a crystallized state, the crystals being of a beautiful fern-like appearance.

Glycerine was likewise made to crystallize; and cognac, after having been frozen, was found to possess that peculiar mellowness commonly attained by long keeping.

But the most important application of the refrigerating machinery has been the purification of chloroform, undertaken by Prof. Pictet at the instance of Prof. Liebreich, of the Pharmacological Institute, Berlin. Chloroform has hitherto been considered a most unstable and easily defiled substance. The action of sunlight, the slight impurities retained from different processes of manufacture, perhaps the mere settling down during protracted storage, have invariably resulted in a more or less marked decomposition. By the simple process of crystallization this unstableness is got rid of, and a practically unchangeable liquid is produced. The crystals begin to form at —68°, first covering the bottom of the vessel, and gradually filling it up to within one-fifth of the whole volume. This residue being drained off, the frozen part is allowed to melt under cover, so as to exclude the atmospheric moisture. Chloroform thus refined has, by way of testing its durability, remained exposed on the roof in a light brown bottle from November till June, without the slightest sign of decomposition.

[*Written for* ICE AND REFRIGERATION.]

"THE ICE MACHINE OF THE FUTURE."

THE WAIL OF THE INVENTOR—THE STUMBLING BLOCK HE SEES IN THE WAY OF THE JUST—LAZARUS AND HIS WRESTLE WITH DIVES.

By THOMAS ROSE.

From the general tenor of Mr. Stuart St. Clair's article upon the above subject in your December number, it is easy to see that his sympathies are entirely with the manufacturing and financial element; nevertheless, his righteous kick at the fakirs and geniuses is not a whit too vigorous. And he is mightily right where he says that all legitimate advancement is the result of "thought, and lots of it."

Geniuses are all very well in their way, no doubt, but the ranks of scientific investigation and improvement in the arts and manufactures are no place for them. This sort is not born of genius; it does not come by fasting and prayer even; and faith without works is dead. The genius who starts out to lift himself over a fence by his suspenders will never get there, because his work has been misapplied, and such work only results in loss of energy. Probably the "rule of thumb" is near enough for flights of genius, but when applied to the exact sciences it is the poorest sort of a rule; for these must be manipulated in accordance with physical laws; no other rule will apply. And what does this involve? Manifestly that, genius or no genius, he must be familiar with those laws at the start if he hopes to be in the race. Why, a knowledge of these same physical laws is the intelligent inventor's stock in trade and kit of tools combined—and what a kit! Yet he must possess them; else had he better turn to rail splitting or hoeing corn than attempt inventions of any magnitude, for assuredly the winner will be among those who know nature's laws the best, stick to them the closest, and achieve at the lowest cost. No genius here, simply work born of knowledge; in other words, "thought, and lots of it."

Now permit me to do a little "kicking" upon this subject, from the inventor's standpoint; because they also suffer, and in a much greater degree, from the fakirs and so-called geniuses. At the very worst, Dives only loses a little cash, which he can very well afford to do occasionally, seeing that he will in all probability more than recoup himself out of the next poor mortal who comes along with an invention to trade off. But the case is altogether different with the inventor. He may stand to lose a well merited harvest after half a life time of privation, provocation and the worst kind of knocks, because it goes without saying, that every genuine inventor is of the true Lazarus type. It must be so, or he would never be such an ass (and here an apology is due to the quadruped) as to bother with inventions at all, knowing that the chances of emolument are so exceedingly remote. And suppose he "slips up" in the end, as he sometimes does, what has he to fall back upon? Not "the crumbs that fall from the rich man's table," because Dives wants the crumbs for the successful man, not for one who fails; and he parts with them grudgingly even then. No, let the inventor get worsted in the struggle, and there won't be so much as a dog left to lick his sores. A single word will suffice for his epitaph: "Ichabod," and two or three more will complete his *In Memoriam:* "Served the pesky old crank right."

Bad as the fakirs and geniuses unquestionably are, they are among the most insignificant of the legion of enemies that confront the inventor on his dubious way. We shall only refer to two or three of them, however, just by way of illustration. *Vested interests* is a formidable one; because a change of method often means remodeling an entire plant, involving an outlay, perhaps, amounting to hundreds of thousands of dollars. So, in many cases, the parties interested combine to crush out the inventor instead of adopting his methods. Or, if there is a chance of his succeeding elsewhere, they will chip in *pro rata* and buy up his patents at the lowest possible figure, when his cherished pet, that he had so fondly hoped to see flourishing around the world, will be immured in the shades of some safe deposit vault. Admit that he does get money enough to keep the wolf from the door for the few years of life that yet remain to him, this does not suffice; he prizes the fruit of his mind more than most men do the "fruit of their loins." And why not? The commodity is by far the rarer of the two; and there is small satisfaction in having it consigned to the sepulcher as soon as it is born.

But the one stupendous stumbling block in the path of the inventor is the modern expert. He is the "great gulf fixed" between Dives and Lazarus, metaphorically speaking. It is upon this rock the inventor splits. To sheol with the expert, for 'tis there he belongs!

Mr. St. Clair has portrayed the fakir very graphically; now if he will only give us a pen and ink sketch of the heaven-born expert from his point of view, we shall be forever grateful. There are many things we want to know about this phenomenon, anomaly, paradox, or whatever he is; especially inform us how it happens that he knows more in five minutes about things that he has never seen, heard of, or even dreamed about, than the inventor does after having studied the subject closely and laboriously, for twenty years or more? Whence comes his truly marvelous intuition? And what is his mission on earth? Is his mission to hunt down the troublesome inventor? How in thunder does he know whether a thing will succeed or fail, when he is totally ignorant of the very A B C of the science upon which its action depends?

Now, if we turn from this specimen and study the more refined species, we encounter the same base intent, only cloaked under a more polished garb. Suppose him to have climbed two or three steps up the ladder of fame and tacked on a rider, as it were, to his original title. Then our trembling inventor will be solemnly introduced to his High Mightiness "Dr. So and So, our consulting chemist." Now heaven help him, for no earthly power can avail him aught. He will never get out half a dozen words of explanation ere this embodiment of all wisdom will be bubbling over with kilos, calories, boiling points, gaseous tensions, adiabatic curves, Morin's laws, thermodynamic formulæ and what not, to such an alarming extent that the whole firmament will be obscured by the froth. If the poor devil of an inventor has never met this genus before, peradventure he will delude himself with the idea that his chance will come when the frothing subsides. Alas, vain hope! No sooner does he get in two or three words in edgewise than the redoubtable C. C. has caught his second wind, and off he goes again, in the

most vigorous manner, to show where everything must of necessity be wrong that the great corporation which his profound erudition adorns is not doing already. They know it all; and, thanks to his presence and perspicuity, are getting all out of the thing that there is in it—yea, to the very last percentage of a degree of the theoretical possibilities; and so on and so on *ad nauseam, ad infinitum*. About this time our inventor friend gets as mad as Hamlet, and exclaims, "There are more things in heaven and earth, Horatio, than are dreamt of in our philosophy"; and with another forcible quotation from the Athanasian creed he closes the interview, vowing that if Dives can only be reached through the modern expert, then Dives may go "where the woodbine twineth," and take his filthy lucre along with him!

Well, I declare, after all, I have said nothing about the "Ice Machine of the Future." But I have voided much acidity, and feel relieved! In a future paper, an you wish it, Mr. Editor, I will stick more closely to the text, and give your numerous readers my views about these "machines of the future," judging from an intimate acquaintance with those of the past and present.

HOW ICE IS FORMED.

A person who has never closely observed the operation of nature's great ice factory will be surprised to find how interesting it is. You need not go outside of a comfortably heated room to do this. Just place a pan of water on the window sill, when the temperature is below the freezing point, and you will soon see something that cannot fail to interest you. If you happen to have a magnifying glass, a single lens, so much the better, for the magnifying power will reveal much of the delicate work of ice making that is invisible to the naked eye.

Anyway, as you closely watch the surface of the water you will soon see tiny little lances, very beautiful when seen under the microscope, shooting hither and thither on the surface of the water. If it is cold enough to make ice in the sunlight the crystal lances will glow with all the colors of the rainbow, and, as they dart about, the rapid changes of color will remind you of the wonders of the kaleidoscope. As the water continues to chill, the little lances come together, and then smaller and still more delicate crystals will be seen forming between the lances and welding them together. This process goes on until the surface is covered with a beautiful film of ice, hardly strong enough to bear the weight of a mosquito. But the process goes on under this superficial layer, and a smooth and solid surface is the result.

Water is affected by changes of temperature differently from all other liquids. It seems to be a natural law for all liquids to expand in proportion to their increase in temperature, but there is a strange exception to the rule in the case of water. For example, take a quantity of water when exactly at the freezing point, 32° above zero, and place it over a fire. As the temperature rises the volume will contract, contrary to the rule, until the water is about 7° warmer than it was at the beginning of the experiment. At that point, however, there is a sudden change. Contraction ceases, expansion begins, and the volume increases until the water is converted into steam.

SELF-PURIFICATION OF RIVERS.

"At the annual congress of German naturalists and medical men just held at Halle, an interesting paper was read in the hygienic section, by Prof. Von Pettenkofer, on the self-purification of rivers," says a foreign exchange. "His researches and experiments were made on the waters of the river Iser, at Munich, but they can be applied to the water of all town rivers. Munich has 280,000 inhabitants, and 20,440 kilogrammes of refuse are carried into the river every day. But, again, each day 3,456,000 cubic centimeters of fresh water flow down the stream, so that the proportion of refuse or dirt to the water is only six to 1,000,000, or six milligrammes to the liter, a pollution which, if artificially produced in a glass of water, is unrecognizable to the naked eye. Careful examination has shown that even this pollution disappears seven kilometers below the city. This self-purification of rivers had hitherto been attributed to sedimentary deposits, but Pettenkofer is convinced that it is the effect of oxygen, partly freely dissolved in or absorbed by the water and partly produced by water plants. He considers that the great quantity of low vegetable organisms in water plays a great part in the purifying process." These results are considerably different from those obtained by American analysts, who find that our rivers purify themselves very slowly. But after all, the alarm of impure ice from so-called polluted streams is largely magnified, if the ice be taken at long distances from the source of the pollution; the germs of typhoid, diphtheria and a very few others being the most dangerous. To totally avoid these it is, perhaps, necessary to avoid streams entirely which may be in anywise affected by sewage.

WHY SNOW IS WHITE.

The pure white luster of snow is due to the fact that all the elementary colors of light are blended together in the radiance that is thrown off from the surface of the crystals. It is quite possible to examine the individual snow crystals in such a way as to detect these several colors before they are mingled together to constitute the compound impression of whiteness upon the eye. The snow is then clothed with all the varied hues of the rainbow. The soft whiteness of the snow is also in some degree referable to the large quantity of air which is entangled amid the frozen particles.

Snow is composed of a great number of minute crystals. More than 1,000 distinct forms of snow crystals have been enumerated by various observers. One hundred and fifty-one were noticed during eight days in February and March, 1855, by Mr. Glashier, which were carefully drawn, engraved and printed in a paper attached to the report of the British Meteorological Society for that year.

These minute crystals and prisms reflect all the compound rays of which white light consists. Sheets of snow on the ground are known to reflect beautiful pink and blue tints under certain angles of sunshine, and to fling back so much light as to be painful to the eyes by day, and to guide the traveler, in the absence of moonshine, by night.

The Colorado Midland Railway Co. has decided to establish a tri-weekly refrigerator car service between Denver and Florrissant, Colo., for the Cupple creek trade.

[*Written for* ICE AND REFRIGERATION.]

BACTERIOLOGICAL EXAMINATION OF AIR.

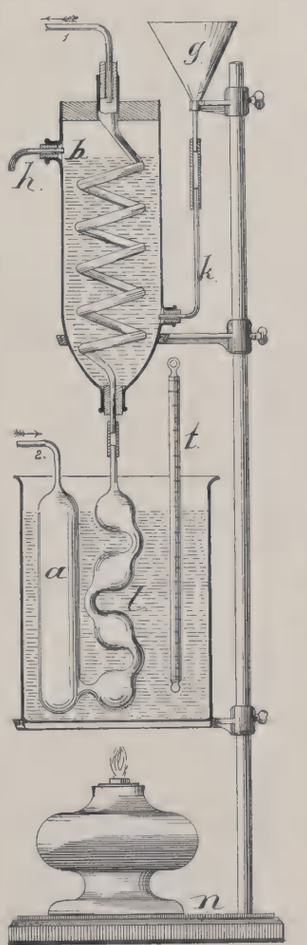
By J. E. SIEBEL.



SOME time ago I showed that bacterial germs were especially prone to be deposited with moisture separating from air supersaturated with humidity; I also demonstrated that air could be perfectly freed from bacterial germs by saturating the same with moisture at as high a temperature as is compatible with the non-destruction of the germs, and subsequently carrying the air through a revolving device by which most of the moisture is caused to subside, taking with it all the germs contained in the air so treated. At the same time I described an apparatus in which this principle was utilized as a means for a more reliable bacteriological analysis of air than was afforded by the means hitherto employed for this purpose.

The device herewith illustrated is calculated to serve the same purpose, but differs from the one described heretofore, in that it is simpler in construction, permits larger quantites of air to be examined, and yields liquids more concentrated in germs.

The air to be examined is taken into the Mitcherlich tube *a* by means of the tube 2, through which it is drawn by means of an aspirator, or similar device, connected with the tube 1 at the top end of the Liebig condenser 6. The Mitcherlich tube *a* is placed in a water bath *l* kept at a constant temperature (not exceeding 120° F.) by means of the lamp *n* and the thermometer *t*. When the apparatus is to be used, some pure sterilized water is put into the Mitcherlich tube, and the Liebig condenser is kept cold by means of ice water and iced brine. The tube 2 opens into the locality, the air of which is to be examined, and a known volume (measured by the aspirator or by a gas meter acting like a fan) of the same is thus caused to pass through the water contained in *a* at a temperature of 115° F., or thereabouts; it is here saturated with moisture at this elevated temperature, but while subsequently passing through the Liebig condenser, most of the moisture is precipitated on the walls of the condenser, carrying down all the germs originally contained in the air. The water condensed in the Liebig cooler flows back into the Mitcherlich tube, provided the pipes are sufficiently wide to prevent clogging, otherwise the aspiration must be interrupted from time to time, to allow the condensed water to flow back, and to avoid too much resistance on the aspirator. In this way the same amount of water is used over and over again, and, owing to the intimate contact, large quantities of air can be treated in a comparatively short time. After a sufficient amount of air has passed the apparatus, the cooler is rinsed with some pure sterilized water, and finally the water collected in *a*, or an aliquot portion of the same, is used for further examination, for plate cultures or otherwise. Steam generated in a glass flask can be readily blown through the apparatus by a pipe attached at 2, and in this manner the apparatus can be effectually sterilized.



The Liebig cooler in this apparatus may also be replaced by a back flow cooler, on the principle of those used in fat extractors, thus preventing the condensed moisture from unduly clogging the passage, without necessitating an interruption in the working of the aspirator.

A FROZEN WELL.

Even scientists are not free from perplexities, and nature is constantly revealing something to cause them study and doubt. Perhaps one of the most marked examples of this is found in the phenomena presented by a well at Yakutsk, Siberia. As long ago as 1828 a Russian merchant began to sink this noted well, and after working on it for three years, gave it up as a bad job, having at that time sunk it to a depth of thirty feet without getting through the frozen ground. He communicated these facts to the Russian Academy of Science, which sent men to take charge of the digging operations at the wonderful well. These scientific gentlemen toiled away at their work for several years, but abandoned it when a depth of 882 feet had been reached, with the earth still frozen as hard as a rock. In 1843 the academy had the temperature of the soil at the sides of the well taken at various depths. From the data thus obtained they came to the startling conclusion that the ground was frozen to a depth exceeding 6,000 feet. Although it is known to meteorologists that the lowest known temperature is in that region of Siberia, it is conceded that not even that rigorous climate could force frost to such a great depth below the surface. After figuring on the subject for over a quarter of a century, geologists have at last come to the conclusion that the great frozen valley of the Lena river was deposited, frozen just as it is found to-day, during the great grinding-up era of the glacial epoch. Eight hundred and eighty-two feet of frozen soil might well stagger the scientific investigator, for it violates all the preconceived ideas of the condition and temperature of the interior of the earth. The conclusion reached is probably the correct one, although the length of time it required to reach it leads to the impression that there may be some uncertainty about it yet.

The Want and For Sale Department of the advertising columns of ICE AND REFRIGERATION should be carefully read; for it usually contains information of men or machinery that can be obtained in no other way and nowhere else. It is one of the most valuable departments in the paper to the reader actually engaged in business, and invaluable to those who have minor wants to make known.

TRADE CORRESPONDENCE.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

HERE IS A PROBLEM.

To the Editor: We send you by mail to-day, two bolts; one of which was taken from our rectifier last month, and had been in use less than three years. The other is the size of the bolt when placed in position. We could not give you an idea of the bolts without sending them to you; and we think it would be interesting to your readers if you could publish a cut, showing the bolt "before and after taking."



PHOTOGRAPH OF THE TWO BOLTS. FULL SIZE.

Ours is an absorption machine, and we send this inquiry to find if possible what the experience is of those running different machines or compressors, and finding out what the wear and tear of the machines and piping is, and the relative waste of material in the two different makes of machines. We are also anxious to know what is the average length of time that the ordinary coils for condensing ammonia can be depended on. We have had several leaks occur so far this season, and the pipes seem to be eaten out. And judging from the action of the aqua ammonia on these bolts, of which there are nearly two hundred in the rectifier, the pipes must be nearly eaten away.

The makers of the machines insist that the ammonia is poor, or contains some foreign substance, while the manufacturers of the ammonia insist that it is made from the pure sulphate.

As the durability of the ice machine is going to enter largely into the question of manufactured *v.* natural ice, and as all mechanics are thoroughly posted as to the lasting qualities of the steam engine, the life of the ammonia system is what we are anxious to find out. This is a question of the utmost importance to all concerned, and we shall look forward to the answer to this inquiry, with a great deal of interest. W. B. BAKER.

SPRINGFIELD, ILL., March 23.

A SUGGESTION.

To the Editor: Please ask through your valuable columns why ice machine builders do not put a gauge in the engine room, say coupled with the ammonia gauges, showing what back pressure is in the condenser (steam) or exhaust pipe. Some have relief valves, but this reduces the amount of distilling water when condensing ceases. For instance, at several plants I have visited the condensers are invariably placed on top of the buildings. Now, the night crew, or engineer, have not the opportunity to watch (or go up to see—many do not if they could) the water over the steam condensers. The consequence is high back pressure. This means more fuel. Some plants use from gang wells, others from water works in connection with wells. In the event of a reduction of pressure, or a rise of temperature, it is readily noticed on the gauge, thus at once notifying the engineer on watch. I am satisfied it will pay in the long run. I mention this for the benefit of my fellow ice men; have tried it and see its benefits, because on going into my plant I see in a moment what pressure is on the condenser.

J. J. CREIGHTON.

CORSICANA, TEX., March 17.

ANOTHER SUGGESTION.

To the Editor: For some time I have been anxious to place before ice manufacturers a suggestion in regard to such points as have a limited supply of water, and other points where the water contains minerals.

In some sections of this state saw mills are using dry kilns, using exhaust steam, driven by the means of a blower or fan, driving air through a series of coils similar to the steam condensers used in ice factories, providing they have no more back pressure than by condensing with water. There are a good many ice factories that have sufficient supply of water for their ammonia condensers and boilers, but not for their steam condensers, having to waste so much, owing to its high temperature. Again, as I have observed on visiting some factories, the mineral ingredients in the water formed a scale on the steam condenser, compelling the owners of same to duplicate them, chipping the scales off of one while using the other, also causing a loss of fuel by back pressure during the formation of said scales.

Again, the present advancement in ice machines by economy in fuel, often necessitates live steam to be used (commonly known as a bleeder) to supply sufficient distilled water. Now, the extra power or steam used to drive this fan could be utilized in making this water and avoid a great deal of trouble and expense by parties having hard water, and such places where the supply is limited.

I would like to hear from manufacturers of fans and blowers on this subject through your valuable paper: The cost per horse power to condense steam by air, which I am satisfied will pay them, and be a boon to many troubled as above stated.

CORSICANA, TEX., March 1. J. J. C.

MINOR LEGAL NOTES.

——Matthias Stutz, of Pewaukee, Wis., has begun suit against Armour & Co. for $25,000 damages for injuries sustained while on the scaffolding of the defendant.

——The Spring Lake Ice Co., Toledo, Ohio, has begun suit against five insurance companies to recover $7,000 insurance on ice houses burned at Spring Lake, Mich.

——Wm. Owens sues the Standard Ice Co., of Indianapolis, Ind., for $10,000 damages. While driving a fractious team, while in the employ of the company, he had two ribs broken by one of the animals.

——C. D. Root, ice dealer at Kalamazoo, Mich., has begun suit against Thomas and Richard, J. B. Westnedge and John Cousins, who own land adjoining the paper mill pond, to prevent them from cutting ice from the pond until a question of ownership is settled. The paper mill company claims that it owns the right of the flow of water through the pond, and with that understanding gave Mr. Root a contract allowing him the exclusive right of cutting ice on the pond. The defendants began cutting ice opposite their land, hence the suit.

——Two suits against the Milwaukee & Northern Railroad Co. were recently heard in the circuit court, at Milwaukee, which were brought to recover damages sustained by the Jefferson Ice Co. and the Kurz & Huttenlocher Co. by the burning of the ice houses on Lake Winnebago, near Menasha, on May 17, 1890. At the request of the ice companies, or their lessor of lands for them, the defendant railroad built a side track to their ice houses to facilitate shipping. A lot of sawdust and hay, used in packing ice, was on the ground, as the defendant claims, between the tracks and the ice house. It was ignited by a spark from the locomotive or the dropping out of live coals from the ash pan, as the plaintiffs claim. The defense of the railroad company is that the plaintiffs were negligent in allowing the combustible material to lie around the track, and that the locomotive ash pan was so perfectly constructed that no coals could fall out. Two verdicts were returned by the jury. They found that the ice houses were set on fire by a spark, cinder or coal escaping from the engine of the defendant railroad company. The question, "Was the defendant, in the manner in which its road bed was constructed, guilty of negligence which caused the destruction of the plaintiff's property?" was answered in the negative. The last question of the special verdict was as to amount of damages, the jury finding, in the case of the Kurz & Huttenlocher Ice Co. damages of $12,335.71; and in the case of the Jefferson Ice Co., $7,779.65. The finding of the jury, however, that the plaintiff ice companies were guilty of contributory negligence, of course, throws the matter back as a mere question of law, in which if the plaintiffs contributed to their own damage by their neglect they are not entitled to recover. The cases are of great interest to people carrying insurance on their property, and they will probably go to the supreme court.

——The E. St. Louis Packing Co. has resumed operations after a stoppage, during which $100,000 were spent in improvements, including the introduction of refrigerating machines.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

·.· APRIL, 1892 ·.·

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1892, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

INDEX TO ADVERTISERS.

Ainsley, Cochran & Co.....310
Ajax Metal Co 285
Alaska Refrigerator Co.....286
Allison Coupon Co.....282
American Fluoride Co.....285
Am. Ice Machine Co., of N. Y....311
American Ice Machine Co. of St. Louis.....304
Argand Grate Bar Co.....247
Armstrong, Bro. & Co.....294
Armstrong Mfg. Co.....300
Arnold & Co.....293
Automatic Refrigerator and Ice Machine Co.....304

Baragwanath, Wm. & Son.....246
Barden, Adamson & Co.....290
Bartlett, Hayward & Co., Outside Back Cover.
Billington, Jas. H. & Co.....289
Bird, F. W. & Son.....295
Bird Paper Mfg. Co.....294
Black, A. W.....287
Blymyer Ice Machine Co.....312
Bodenstein, J. G. & Co 282
Boggs & Clarke 248
Brandt, Randolph.....289
Briggs, John N.....282
Buffalo Refrig. Machine Co....313
Buhring Water Purifying Co.....284
Burns Mfg. Co.....305
Butz, A. L 295

Callahan, W. P. & Co.....313
Canton Steel Roofing Co.....290
Cardell, James D., & Co.....303
Case Refrig. Machine Co.....308
Castle Ice Machinery Co.....309
Chapman Valve Mfg. Co.....246
Cincinnati Corrugating Co.....291
Clapp, B. P., Ammonia Co.....299
Cleveland Anhydr's Am. Works..298
Columbus Iron Works Co.....306
Conroy, P. J. & Co.....287
Cook, A. D 249
Cook, E. H., Co.....280
Craft Refrigerating Machine Co.309
Crandall Packing Co.....288
Crane Co.....248
Crosby Steam Gage & Valve Co...247

Dalzell, Jas. & Son Co.....285
Davis & Rankin B. & M. Co.....281
Dean Bros.....248
Deane Steam Pump Co.....249
De La Vergne Refrig. Mach. Co..318
De Loach Mill Mfg. Co.....305
Directory of Ice Factories, Ice Dealers & Cold Storage Houses.282
Dixon, Jos. Crucible Co.....285
Dodge, B. G.....293
Downie Bros. & Nevin.....245
Dunlevy Sheet Iron Works.....291

Edson, Jarvis B.....300
Electric Pipe Bending Co.....301
Epping, Carpenter & Co.....249

Farrell & Rempe 304
Featherstone's Sons, John.....317
Field Feed Water Purifier Co....292
Fletcher, I. D.....298
Foster, Brown & Co.....298
Foster Pump Works.....249
Frick Co.....320, 321

Galigher, F. L.....281
Garlock Packing Co.....289

Geiger, Fiske & Co.....290
Gifford Bros.....282
Goodrich, B. F., Co.....298
Gordon Steam Pump Co.....244
Grand Rapids Refrig. Co., The...286
Graver, Wm.....288

Hall Engineering Co.....281
Harrisburg Pipe Bend. Co., Ltd..302
Heerdegen & Schnee.....285
Heller, Hirsh & Co.....298
Hercules Iron Works.....243
Hendrick Mfg. Co., Ltd.....308
Hillyer, E. C. & Co.....314
Hilpert & Chandler.....290
Hine Eliminator Co.....280, 283
Herf & Frerichs Chemical Co.....250
Holmes, S. T.....284
Hoppes Mfg. Co.....246

Illinois Metallic Pkg. Co.....289
Isbell-Porter Co.....307
I. & R. Binder 000

Jackson Refrigerator Co.....286
Jewell, O. H., Filter Co.. 284
Johnson, McCarthy & Johnson...309

Kahnweiler, David.....295
Kendall, Edward & Sons.....288
Kenly, D. F. & Co.....290
Keystone Chemical Co.....284
Kilbourn, J. K.....281
Krausch Co., The Theodore.....307
Krebs, H. J.....297
Kiechler Mfg. Co.....291

Laidlaw & Dunn Co., The.....248
Lansing Iron and Engine Works.288
Lawson, Enoch.....247
Loomis Imp. Filter Co.....285
Lord, S. W. & Co.....296
Louisville Pipe Bending Co.....300
Lunkenheimer Brass Mfg. Co....247

McCray Refrig. and C. S. Co.....286
McKinley & Garrett Hydraulic Motor Co.....292
Mackolite Plaster Board Co.....294
Maris Machine Co.....296
Maritzen, Aug.....283
Mason Regulator Co.....244
Merchant & Co 296
Miami Valley Boiler Co.....288
Mid-Continent Manufacturing Co247
Miller, Jas. A. & Bro.....290
Missouri Refrigerator Manufacturing Co.....287
Mitchell, Thos.....289
Morse Elevator Works.....296
Moyer, J. W.....297

National Am. Co., Outside Back Cover.
N. Y. Coal Tar Chemical Co.....299
Nubian Iron Enamel Co., The....280

Otto Gas Engine Works.....245

Peirce, A. H. Mfg. Co.....290
Pennsylvania Iron Works Co.....316
Perrin, W. R. & Co.....296
Philper, H. H.....305
Phosphor Bronze Sm'lt'g Co., Ltd285
Pontifex Ice Machine Co., The...308

Queen City O. and W. Mfg. Co .290

Reading Iron Co.. 303
Reeves, Paul S 285
Reliance Gauge Co.....247
Remington Machine Co.....306
Rinald Bros.....287
Ripley & Bronson.....245
Ripley Isinglass ... .298
Rosengarten & Sons.....298

Samson Steam Forge Co.....301
Sauls Bros.....290
Seibel-Suessdorf C. & I. Mfg. Co..291
Shipman Engine Co.....245
Sicilian Asphalt Paving Co.....295
Smith & Vaile Co.....244
Southern Ice Machine Co.....315
St. John Cylinder Packing Co....289
Standard Paint Co.....295
Standard Thermometer Co...244, 299
Stilwell & Bierce Mfg. Co.. 283
Stromberg, Allen & Co., Outside Back Cover.
Sulzer-Vogt Machine Co.....311
Swanitz, A. W.....281

U. S. Mineral Wool Co 294

Valley Pump Co.....248
Van Winkle Gin and Mach. Co...308
Vulcan Iron Works, The.....309

Wainwright Mfg. Co., of Mass...245
Wants, and For Sale, Etc.....280
Watson, H. F., Co.....295
Weisel & Vilter Mfg. Co..... 311
Weiskopf, A..... 299
Westerlin & Campbell.....281
Western Ice Machine Co.....310
Western Mineral Wool Co.....292
Whitehill E. and P. I. Machine Co.....319
Wilson-Snyder Co.....322
Wingate & Mell..... 291
Wolf, Otto C.....Inside Front Cover
Wolf, The Fred W. Co.....250
Wood, Wm. T., & Co.....282
Woolford, Geo.....285
Wright, T. B. & Co.....285

York Mfg. Co., Inside of Back Cover

Zurn, O. F. & Co.....285

ASSOCIATIONS AGAIN.

While the Birmingham, Ala., press treated the Southern Ice Exchange, at the late annual meeting held in that city in February last, as reported in the last issue of ICE AND REFRIGERATION, very kindly indeed, nevertheless it is worthy of remark that every press telegram in relation to the meeting sent out from the city spoke of the Exchange as a "trust." This unjust reference must be attributable rather to a sort of "trust-phobia," which in these days makes its appearance in reportorial circles whenever two or three business men of similar interests are gathered together for business purposes, rather than to anything which appears in the proceedings of the Exchange itself, which are barren of the faintest indication of trust organization or purposes as the word "trust" is now understood when applied to mercantile or manufacturing organizations.

The Southern Ice Exchange, so far from being a "trust," is simply an organization of gentlemen representing certain ice factories in the South, for the purpose of meeting together annually to discuss the problems which arise in the mean time in their business. It can hardly be dignified even by the title of a "mutual protective association," much less as an aggressive combination to be styled a trust. It is to be hoped, however, that the effort to secure an increased membership will be so far successful as to give the Exchange much more than it now has the character of at least a defensive organization. As such it might become an organization of some material advantage to the members and the trade generally throughout the south.

The present season will, we apprehend, before its close emphasize the necessity of a more potent organization than the Exchange has thus far been, unless it should in the end prove more successful in a pecuniary point of view than it now promises to be. The evils of the threatened warfare might be reduced in effect if the ice makers of the South generally could come together through the mediumship of the Exchange and each individual come to a complete understanding of the situation. This is the purpose, and the only active purpose, of the Exchange. It is a laudable one; and if the Exchange could receive the hearty coöperation and support of all the ice manufacturers of the South as individuals it could accomplish a great deal which would redound to the personal benefit of each individual manufacturer. Its present necessity to the trade is the Exchange's best recommendation to the attention of the individual members of that trade.

ANSWERS TO CORRESPONDENTS.

ISOTHERMIC AND DEABATIC CURVES—COST OF MAKING ICE—EFFECT OF CLEARANCE—REFRIGERATING CAPACITY—WATER FOR CONDENSER—FREEZING ICE.

This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest. Correspondents, especially when asking questions of a technical character, cannot be too explicit in giving details. In stating temperatures, the kind of scale should be indicated; and in giving pressures it is well to state if pressure above that of the atmospheric pressure or above vacuum is meant. Write on one side of the sheet only.—ED.

To the Editor: Kindly inform me through the columns of your valuable paper how to construct the "Isothermic" and "Adiabatic" curves of an ammonia compressor, with condens ng temperatures of 60°, 80° and 100° F., without using elaborate mathematical terms, such as are employed by "Wood" and other writers. J. S.

ANSWER.—The equations which govern the relation betwen pressure and volume of ammonia gas and which determine the course of the isothermal and adiabatic curves of this gas, their deviations from the like curves appertaining to perfect or nearly perfect gases, are dictated by the peculiar qualities of ammonia. The specific heat of this gas if saturated is negative, so that in expanding adiabatically a portion of it will condense, and in compressing the gas adiabatically it will superheat for the same reason; moreover it does not follow Boyle's law. For these reasons the formulæ referred to in your question cannot be so simple as those of a perfect gas, still they are as simple as they well can be under the circumstances, and any attempt to simplify them could hardly result in anything but a circumscription or a more clumsy demonstration which would obscure the subject rather than enlighten the reader. Curves representing the actual working of a compressor under different circumstances may, of course, be readily obtained by the use of an indicator.

COST OF MAKING ICE.

To the Editor: What is the cost of making ice per ton? C. H. F.

ANSWER.—This question, small as it is, covers a vast deal of ground, the cost of ice per ton depending largely on local circumstances which differ widely in each individual case. Taking equally well appointed plants of the same size, a difference in cost would be brought about by any difference in the price of fuel, the expense of obtaining the water for the condenser, the temperature of this water and other circumstances. Under otherwise good working conditions we should think the actual cost per ton at the factory might run from $1.00 to $2.50 per ton. But these figures may be largely increased if the demand is irregular, if some of the product has to be stored, or if the machines cannot be kept working regularly and at their full capacity by unforeseen repairs becoming necessary through accident, neglect or otherwise, loss of ammonia and in various other ways.

EFFECT OF CLEARANCE.

To the Editor: Should be pleased if in your next issue you would give a plain explanation showing the bad effect of clearance in an ammonia compressor working under different conditions without the use of complicated diagrams and differential calculus, as is done in a treatise on this subject in the March issue of your valuable paper. P. V.

ANSWER.—In the article you refer to no differential calculus is used, and you have been scared unnecessarily, probably on account of the subscripts x and y which are used in some corners of the diagrams in connection with the letter d. However, maybe the subject will become plainer to you in the following diction: Suppose n to be the actual clearance or space left between piston and cylinder after the former is fully brought home, in cubic feet; then that space is filled with ammonia of the same pressure as that in the condenser. On its way back, the piston has to travel a certain way, before it can take in ammonia from the refrigerator coils in order to give the ammonia n a chance to expand from the pressure obtaining in condenser coils to that in the refrigerator coils. The amount of this expansion therefore reduces the theoretical capacity of the machine which is calculated on the basis of a full stroke of piston for just so much. If w is the weight of a certain volume of ammonia at the pressure obtaining in the condenser, and w_1 the weight of the same volume of ammonia at the pressure prevailing in refrigerator $\frac{n\,w}{w_1} - n$ would be the amount of expansion above referred to; and if V be the volume traversed by the piston each stroke in cubic feet, the useful portion of that volume is reduced, therefore, from V to

$$V - \left(\frac{n\,w}{w_1} - n\right)$$

and in the same way if the theoretical capacity of a compressor be C the capacity C_1, corrected in accordance with clearance would be expressed by the following equation:

$$C_1 = \frac{C\left[V - \left(\frac{n\,w}{w_1} - n\right)\right]}{V}$$

or

$$C_1 = \frac{C\left[V - n\left(\frac{w}{w_1} - 1\right)\right]}{V}$$

This is virtually the same result as that demonstrated in Mr. Post's discussion, and shows at a glance that the bad effects of clearance increase with the difference between w and w_1; that is, with the difference of pressure in condenser and refrigerator coils.

REFRIGERATING CAPACITY.

To the Editor: Can the refrigerating capacity of a direct expansion ice machine be calculated from the work it does in cooling wort in a brewery, the wort running over a Baudelot cooler, and the ammonia expanding within the same? If so what would be the capacity of a machine, expressed in tons of refrigeration per twenty-four hours, if the same reduces the temperature of 130 barrels of wort from 62° to 40° F. in 100 minutes? P. V. L.

ANSWER.—Assuming the specific gravity of the wort to be 1.049, and taking the barrel at thirty-one gallons, and the gallon water at 8⅓ pounds, the weight of the above amount of wort is equal to

$$130 \times 1.049 \times 31 \times 8\tfrac{1}{3} = 35{,}230 \text{ pounds},$$

and assuming the specific heat of the wort to be 0.91, the heat withdrawn from above amount of wort is equal to

$$35{,}230 \times 22 \times 0.91 = 705{,}300 \text{ T. U.},$$

or expressed in tons of refrigeration in twenty-four hours,

$$\frac{705{,}300 \times 24 \times 60}{100 \times 284\,000} = 35.76 \text{ tons.}$$

As a matter of course, the expression of capacity obtained in this way holds good only as long as the machine works under these same conditions; if worked at other temperatures, the results would be different.

WATER FOR CONDENSER.

To the Editor: We are using a submerged condenser at present in connection with our ice machine, but it is about to give out, and we are thinking of putting in a surface condenser instead, but have been cautioned on account of the water, which being artesian well water, is said to form a deposit on the pipes. The water which we use on the condenser contains, according to chemical analysis, besides minute quantities of other ingredients, the following substances, expressed in grains per gallon.

Chloride of magnesium	9.9
Carbonate of lime	16.8
Sulphate of lime	25.
Sulphate of soda	20.1

Please give us your opinion in the matter, and tell us if the water is all right to be used in connection with a surface condenser. T. E. B.

ANSWER.—From what we can learn of cases in which similar water to yours is used in connection with a surface condenser the same has indeed a tendency to leave a deposit on the condenser pipes, but by cleaning the pipes, say once in two weeks in the busy season, any hurtful accumulation of deposit can be easily avoided, especially if the condenser coils are provided with a good coating of some mineral paint. The pipes which carry the spent water away from the condenser are subject to become coated with a deposit inside, which cannot be so easily removed as that on the surface coils, and therefore it is possible that such pipe, especially in horizontal sections, may be clogged in the course of time. In such a case there would hardly be any other help, but to take the pipes apart and clean them. At any rate this could not happen but once in a long time.

To the Editor: Please inform me how many hours are required to freeze *solid* 8×12, 12×12 and 14×14 ice in cans, with brine temperatures of 20°, 15°, 10° and 5°. Also how long will it take to freeze the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 9th and 10th inch, in a plate system, with temperatures of 15°, 10°, 5° and 0° in the expansion coils. A. E.

ANSWER.—The "Query man" has attempted the solution of numerous nutty problems, but this rather caps the climax. In fine, he "gives it up." "Art is long" but life is too short, even in these days, to sit down alongside of an ice machine and figure out answers to the fifty-two questions propounded under the varying conditions that would obtain in making the necessary experiments. However, thinking it might be possible that some one had interested himself in the subject, we submitted it to some of our readers. Mr. Lea Pusey, of Wilmington, Del., of the Diamond Ice Co., says: "You flatter me greatly by imagining my range of knowledge of the ice business would enable me to answer the fifty-two questions propounded by your prolific correspondent. I have had only about five years' experience in the manufacture of ice. I hope you will strike some other fellow with more knowledge and experience, as I would like to obtain the correct answers to the fifty-two questions above mentioned, without the expense of experiments. I shall look with renewed interest to the future numbers of your valued monthly review for their solution!" The ice machine men are quite as much in the dark as operators of machines, for unless the circulation of brine in the tank, the amount of water, the temperature of water going into the tank, the amount of work performed by the machine, etc., *ad lib.*, are stated, there can be no intelligent answer given.

A COMPLETE report of the Florida Ice Manufacturers' Association meeting will be published in the May issue.



CONVENTION CALL.

The annual convention of the South-West Ice Manufacturers' Association will be held at the Joplin House, Joplin, Mo., April 23, 1892. All ice manufacturers of the states of Missouri, Kansas and Arkansas, and also of the Indian Territory, are earnestly requested to attend, that the benefits of association may be extended to them, and that they may add their counsel and coöperation in the advancement and protection of mutual interests.

W. O. CALDWELL, *Chairman.*
C. M. GAY, *Secretary.*

NEW BOOKS.

"DIE MECHANISCHE WAERMETHEORIE." Von R. Clausius. Three volumes. Brauschweig: Friedrich Vieweg & Son. Vol. I, third edition, 1887; paper, pp. 403; price, 8 marks. Vol. II, second edition, 1879; paper, pp., 352; price, M. 6.40. Vol. III, second edition, 1889-91; paper, pp. 264; price 8 marks.

The author of these volumes, who, side by side with Zeuner, Rankin and others, is one of the foremost and most successful explorers of the "Mechanical Theory of Heat," *i. e.*, the science of thermodynamics, has deposited in them the original elaborations of the leading conceptions which he held and promulgated on the relations of heat to other natural forces. While no work on heat and motion and kindred subjects would be complete without copious citations from the original researches of Mr. Clausius, yet the student who desires to entirely master the subject of thermodynamics can hardly do so without consulting the author's original treatises in their unabridged form. In the above volumes they are so represented in a comprehensive, exhaustive and systematic manner. The three volumes may be obtained separately, Vol. I containing the explorations of the "Theory of Thermodynamics," as developed from the principal theorems of the science and their application to steam engines. The second volume shows how the principles underlying the mechanical theory of heat may be applied to electrical phenomena. Vol. III contains the analytical development of the conceptions which represent heat as a kind of motion. This volume (its second edition) has been edited by Drs. Planck and Puflich, its revision by the author having been interrupted by the latter's death, which occurred in 1888, in August.

"DIE THEORIE DER WAERME." Von Dr. Her. Scheffler. Braunschweig: Friedrich Vieweg und Sohn. 1875. Paper, pp. 72; price, 2 marks.

This pamphlet is designed as a forerunner of a larger work on "Nature's Laws," in which the author seeks to explain the different natural phenomena by a theory of his own. Those deductions relating to the phenomena of heat are contained in this work, which is illustrated by a plate giving a graphic view of the author's conceptions of molecular action.

"SUBSTANZ UND BEWEGUNG." Von J. Clerk Maxwell. Braunschweig: Friedrich Vieweg und Sohn. 1881. Paper, pp. 142; price, M. 1.20.

This is a translation from the English of the author's work on "Matter and Motion," which is considered one of the leading works on "Kinematics and Dynamics," in the English language. The deductions are largely based on "Hamilton's Principle of Vectors," which lends additional interest to this little work, which will prove to be a great help to those who prefer the German idiom.



The ice harvest is over, and at this writing there is little to add to what was said last month. The harvest throughout the country has been exceptionally good, as a whole. There are a few, but only a very few, localities where the crop is short or poor in quality, but as a whole the crop is satisfactory in every way. Cincinnati is perhaps the only western city within the range of the freezing north-country where the crop is not so satisfactory as was hoped. There will be nothing like a famine during the summer, even not counting the machines, but the ice is thin and rather poor in quality. The Hudson river country has produced nearly an average crop, and even Maine has had enough good weather in March to make up a large part of the deficiency in the cut there on the first of the month.

Along and west of the Missouri river the harvest was made in February, and was the largest cut for years. Iowa, Minnesota, Michigan, Indiana, Illinois and Ohio completed the cut in March, and it may be said that every house is full. Des Moines has 26,000 tons in store; Toledo has over 60,000 tons; South Bend, 45,000 tons, and so on, through the list. The lake cities, besides filling their local houses, have generally Michigan ice in store to draw on if necessary. Illinois river and the lakes and rivers of Minnesota and Wisconsin have also sent large supplies by rail to St. Louis and further shipments by barge will follow when navigation opens.

The Hudson river and New Jersey lakes cutting extended up to March 11, when soft weather put an end to the work for the season. The crop is ample, but there was less work done by speculators this season than usual, perhaps, and up-river dealers on that account expect better New York city sales. The Hudson river cut was rather more expensive than usual, owing to changeable weather, and a good deal of the ice is "off" in quality, though averaging fair. Probably one-third more would have been cut had the weather been generally favorable.

In Maine the first busy season closed about February 23, when warm weather ruined the surface of the ice, then twelve inches thick. At that time on the Penobscot there had been housed between 175,000 and 200,000 tons. A week later, cold weather came again, and cutting was resumed on March 1. Cutting continued until the 12th ult., when it generally ceased, and the season was over.

On the 12th the Gardiner *News* said: "On the Kennebec not much more than two-thirds of the usual crop has been harvested, but it is mostly of excellent quality, although some of it is not nearly as thick as is usually cut, the whole crop averaging from a foot to thirteen inches. On the Penobscot the crop and conditions are just about the same as on the Kennebec. There will be no famine in the ice trade, yet still the crop is such as will cause fair prices and, if not held too long, will net the ice men a handsome margin of profit."

On March 16 the Belfast *Journal* said: "Ice operations on the Kennebec closed last week, and it was expected for the season. The crop is short from 100,000 to 250,000, tons according to different estimates. The expense of gathering is said to have been unusually large, but the ice is of excellent quality. On the Penobscot the expense of harvesting was small; but only about 279,500 tons have been stored, while the ice houses have a capacity of 416,500 tons. The dealers say the houses contain better ice than they have obtained for years. It is expected the ice will bring from $1.25 to $1.75 per ton, which is paying business."

NATURAL ICE NOTES.

——The Silver Lake Ice Co., Omaha, put 65,000 in store.

——The harvest at Helena, Mont., has been a light one.

——E. S. Linxwiler has a new house at Shell Lake, Wis.

——Henry Schneckloth has a new house at Gladbrook, Iowa.

——The asylum at Morristown, N. J., has stored 5,000 tons of ice.

——Walter Bros. have completed a new house at South Superior, Wis.

——The Silver Lake Ice Co., Buffalo, has harvested 65,000 tons at Perry.

——The Penobscot crop will furnish cargoes for about 500 sail of large schooners.

——A. H. Clark has completed a new house at Kingston, Ill. He will import ice by rail.

——Warren Sweeley, of De Pue, Ill., has filled eight barges of ice to be sent to St. Louis.

——Carle Bros. have erected a new house at Luzerne, Pa., to be filled with Harvey's lake ice.

——The Kearney (Neb.) Ice Co. shipped a large quantity of ice to central and western Nebraska towns.

——The Consumers' Ice Co., at Burlington, Vt., housed 6,000 tons of splendid ice, finishing work March 17.

——The ice trade at Madison, Wis., was fairly active during the cutting season, but not equal in magnitude to last year's business.

——The ice cut at Moline, Ill., is shorter than usual, the shipping trade having fallen from 900 cars in 1891 to less than 100 in 1892.

——The Bath (Me.) *Times* says that there is, practically speaking, but little ice to go out of the river this spring between that city and Augusta.

——The ice crop gathered at Lake Hopatcong, Dover, N. J., this year is estimated at 68,974 tons, of which 2,926 car loads were taken away and 28,000 tons stored.

——The Natural Ice Co., of California, have put up a storage house at Visalia, Cal., on the Visalia & Tulare railroad, and a smaller house in the south end of the city.

——The first cargo of new ice to go out of the river for 1892 came down from Pool's landing, East Booth Bay, Me., Tuesday morning, February 17, loaded aboard a three-master.

——The Philadelphia supplies of ice will have to come from outside points in Pennsylvania and New Jersey and Maine, as but little good ice was cut in the immediate neighborhood of the city.

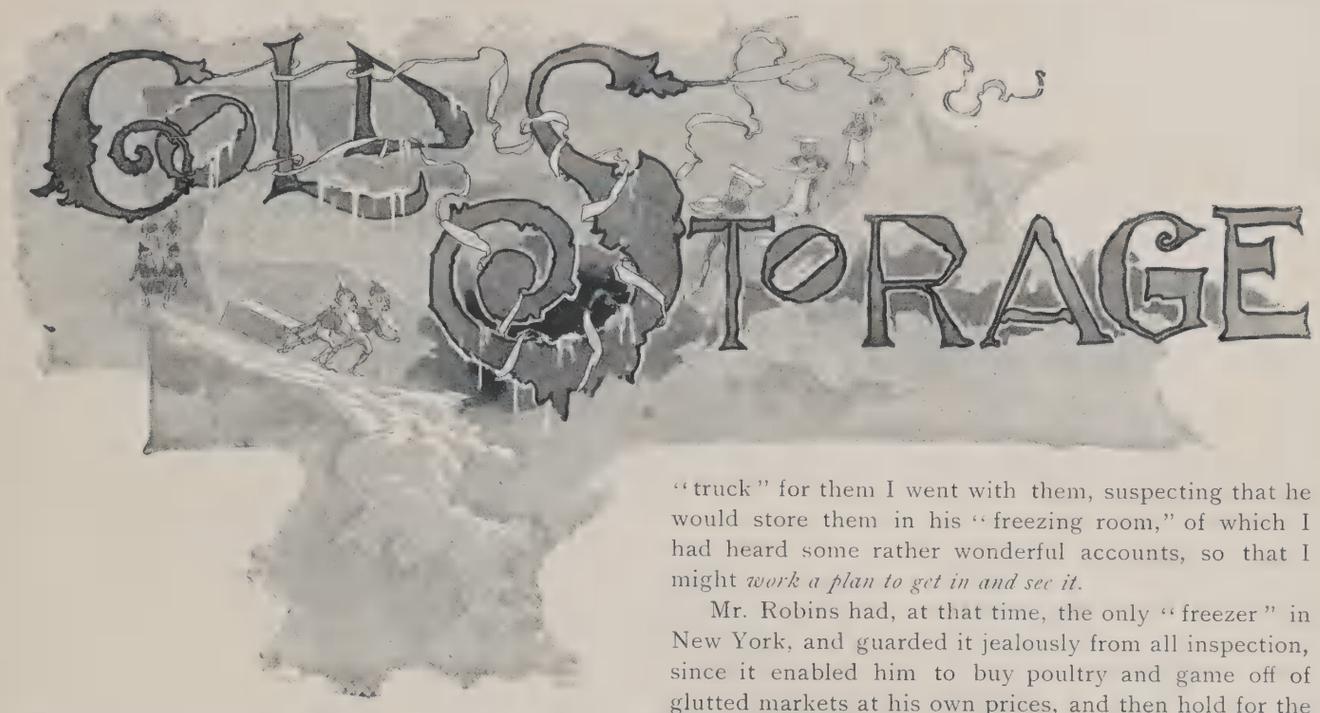
——Ice operators say the season was unprecedented in its lack of ice making weather. Never previous to this has there been a winter, they say, when the houses on the Kennebec could not be filled.

——The rate of $1 per ton, freight by rail on ice from Dixon, Ill., to Chicago, having been objected to, Chairman Midgley has withdrawn his authority to put the rate into effect March 1, as previously announced.

——Duluth, Minn., dealers have experienced considerable difficulty in procuring desirable ice for family use, and as late as March 7, had only begun cutting six to eight-inch ice for that purpose. Of refrigerator ice an abundance was cut early in the season.

——The Kennebec ice fields are pretty good financial institutions to have in a locality. The weekly pay rolls there during the busy cutting season foot up more than $60,000, and the results of the distribution of such an amount there every Saturday are plainly apparent.

——The big ice house at Greenwood lake, Dover, N. J., holding 80,000 tons, is full, and the old house in the cove above, with a capacity of 60,000 tons, is nearly full. In addition to this, a large stock has been put into stacks by W. C. DeGraw at the north side of the lower house. The ice is eleven and twelve inches thick, and remarkably clear and hard.



[*Written for* ICE AND REFRIGERATION.]

THE GAME TRADE.

THE PRAIRIE CHICKEN TRADE OF IOWA THIRTY YEARS AGO—HOW IT WAS HANDLED—A DEALER'S EXPERIENCE WITH GROUSE—ONE OF THE FIRST FREEZERS IN NEW YORK CITY.

By D. B. Beemer.

[*Concluded from March issue, page 189.*]

The next winter I went over to Iowa and bought grouse from station to station, along the C. & N.-W. R. R., from Cedar Rapids to Jefferson, freighting them to Chicago, where I had them held till I returned at the opening of the "close" season, when I again packed the birds in lard tierces, and went with a car load of them down to Baltimore. Leaving the car there, I went down to Washington and sold by sample, forwarding the stock upon my return to Baltimore. After working the Baltimore market also, I went with the car to Philadelphia, and sold freely there; then went on to New York with the balance of the birds. When I got there I found but little stock offering, and felt very "bullish" on mine. I sold some at $1.50 per pair; and Mr. Robins, of Fulton market, bid me $1.25 per pair for the whole lot, which I refused. Next day, however, I learned of free arrival of grouse, and concluded that I would close with Mr. Robins' offer. So I went around to his place of business and skirmished to trap him into repeating it. But Mr. Robins always kept his "weather eye open," and was not to be caught "napping" in that way. He casually made an offer of $1.12½ per pair, which I also refused, believing that I could get $1.25 per pair by the single tierce. But I found I was mistaken in this, as grouse were becoming more plenty every day. I again dropped around to chat with Mr. Robins and feel his pulse in connection with his $1.12½ per pair offer made the previous day. But he had lost his appetite for grouse—could not see any money in them at anything over $1 per pair—thought they would go lower than that; still, as my birds were well handled, etc., he would give $1 per pair that day. I lost no time in taking him at his word. I sold them to him, and when he sent a "truck" for them I went with them, suspecting that he would store them in his "freezing room," of which I had heard some rather wonderful accounts, so that I might *work a plan to get in and see it.*

Mr. Robins had, at that time, the only "freezer" in New York, and guarded it jealously from all inspection, since it enabled him to buy poultry and game off of glutted markets at his own prices, and then hold for the "rise" that always came after a glut and subsequent "clean up."

We arrived at the store where the "freezer" was situated, and the man in charge opened the outside shuttered door to see what was wanted. I bustled off the load with note book and pencil in hand and told him the tierces wanted to go right into the freezer quick, and made a show of checking off the figures on the tierces, as I rolled them inside the door; and when this outer door was closed I was inside and continued to urge the man to hurry them into the freezer *at once*, as it was of great importance that it should be done quickly. He stared at me, evidently trying to "size" me *and my authority* up, but I kept rushing him with the air of a man sent by Robins to boss the job, and he walked across the reception room and opened a door set into a thick wall, from which the cold air rushed, turning to fog as it came into contact with the warmer air of the outside room.

We took in a lighted candle and rolled the tierces in as quickly as possible, and then he hustled me out with himself and slammed the door shut, thinking, no doubt, that it was but little that I could have seen or learned of the construction of the plant by the faint light of the candle, while passing the tierces inside the door; but he was "away off" if he entertained such ideas. When I went out of that room I had the whole interior of it impressed upon my mind and memory by a series of *instantaneous views!*

I first noticed the walls glistening with frost. That meant *a freezing temperature*, sure enough; and I looked *for the cause.* I saw "V"-shaped galvanized iron tanks hanging suspended from the ceiling, to which they were apparently bolted, and through which they must have been fed with ice and salt to coat them with frost and ice, as they were, from condensing the moisture from and out of the room. I also saw broad, shallow pans of galvanized iron suspended from the ceiling of the room, upon which were piled heaps of ice in a dry, frosty condition, while from all these tanks pipes led down to the floor and the sewer openings to take off the drainage.

Barrels and boxes of apparently frozen game and poultry were standing about on the floor, showing that although the apparatus was of a rude and experimental nature, *the required power was there*. It was, in fact, a freezer in embryo—that power which, since improved and elaborated, has revolutionized the trade in perishable goods, and yearly saves millions of money on products which formerly went to waste, but which are now not only *utilized*, but also serve to cheapen them for the masses.

Look at the myriad thousands of cattle now gathered from the great plains of South America and carried in the cold embrace of the ship's "freezer" across the great waste of waters, through the heat of the torrid zone, and landed in frosty freshness of condition upon the distant markets of England, when formerly they were slaughtered for their hides alone! Contemplate the spectacle of the flocks and herds of Australia marching to the sea and their cold sepulture in frozen ranks, in the holds of the ocean racers, to be resurrected at last, after months of time and thousands of miles of ocean travel also, on the far distant shores of England! See the shoals of fish, taken from the waters of the great lakes and estuaries of the sea in warm weather, locked in congealed masses and stored like brick in the great "freezers" of the fish dealers and carried therein till seasons of scarcity! Behold the cattle from our own far west ranges and feed yards, leaving their comparatively waste material at the packing houses and journeying across the country in refrigerator cars to the far eastern markets in condensed form, ready for the butcher's block! And the tropical fruits of far-away California and our great south country alike join in the wheeled procession of "refrigerators," bearing them to markets formerly inaccessible to them, in company with eggs and butter, poultry and game.

ON ICE TEN YEARS.

"It is not ordinarily considered to be in good form to cook and serve a fowl that has been dead longer than two weeks, but the guests at a dinner given in this city a few days ago ate a turkey that was killed ten years ago," says the New York *Times*. "The most singular thing about it, too, was the fact that the turkey looked as fresh as the tenderest bird of the class of '91, and was otherwise like any other recently killed turkey, except that the flesh had lost its flavor.

"The dinner was given by Edward Bell, the broker, in December last. Ten years ago Mr. Bell acquired a Vermont turkey and took it to Knapp & Van Nostrand, 208 Washington street, and asked them to put it on ice. He expressed a desire to experiment in refrigeration with the view of ascertaining how long fresh meat could be kept on ice. It was agreed between Mr. Bell and Knapp & Van Nostrand that the turkey was to be kept on ice for ten years, and then eaten. Accordingly the turkey was hung up in the back part of the big refrigerator. It was a small bird, weighing eight or nine pounds, and had been killed by cutting into the neck. The head was not severed, and the fowl was not 'drawn.' In the refrigerator that turkey dangled from 1881 to 1891. At long intervals it was taken out and shown to Mr. Bell and to customers of Knapp & Van Nostrand. Time and the continuous application of refrigeration did not seem to affect the turkey in any way. Its color did not change.

"At the dinner there were present, among others, besides Mr. Bell, Rev. Morgan Dix and Rev. Halsey W. Knapp, a Brooklyn clergyman, and a member of the firm of Knapp & Van Nostrand. The turkey had been 'drawn' and found to be apparently in perfect condition. It was then cooked and served. The guests ate the turkey with emotions of lively surprise and interest, but were not long in discovering that it had entirely lost its flavor. The flesh was almost absolutely without taste, and was as dry as a bone. All the essential juices had disappeared during the ten-year freeze. The turkey had lost nothing in weight while on ice, and was in fine color.

"The dinner, while certainly unique, was not a success from a gastronomic standpoint. It demonstrated that it is possible to preserve fresh meat for a practically indefinite period in a refrigerated atmosphere, but it made it equally clear that food so preserved loses all the characteristics that make it palatable. Mr. Van Nostrand said yesterday that fowl preserved a year would taste as good as though freshly killed."

AFRICAN PEACHES FOR LONDON.

For some time experiments have been conducted in the shipping of green fruit from the Cape of Good Hope to London. The result of one of these shipments is thus told by the Liverpool *Daily Post:* "A sale took place in Covent Garden, London, recently, of a little cargo of peaches from the Cape of Good Hope. The importation sold for a figure which will amply repay the enterprising fruit growers of South Africa. One box containing thirty-six peaches, all thickly wrapped in cotton wool, fetched the extraordinary price of £4, or rather more than 2s. apiece. The remaining cases, holding from thirty-six to forty-eight peaches, were knocked down at figures ranging from 49s. to 67s., the tenth box realizing only £1. This fact was, however, due to the circumstance that for experimental purposes it had been put into the ordinary meat refrigerator, with the result that the fruit became frozen, and thereby lost the greater part of its value. The others had been shipped in a special chamber, and arrived with as delicate a bloom on their waxy skins as if they had been plucked a few hours before from the tree. In no case, either in the flavor or appearance, were they inferior to the best European specimens; though they were, no doubt, picked samples, which must not be accepted as average types of what will follow."

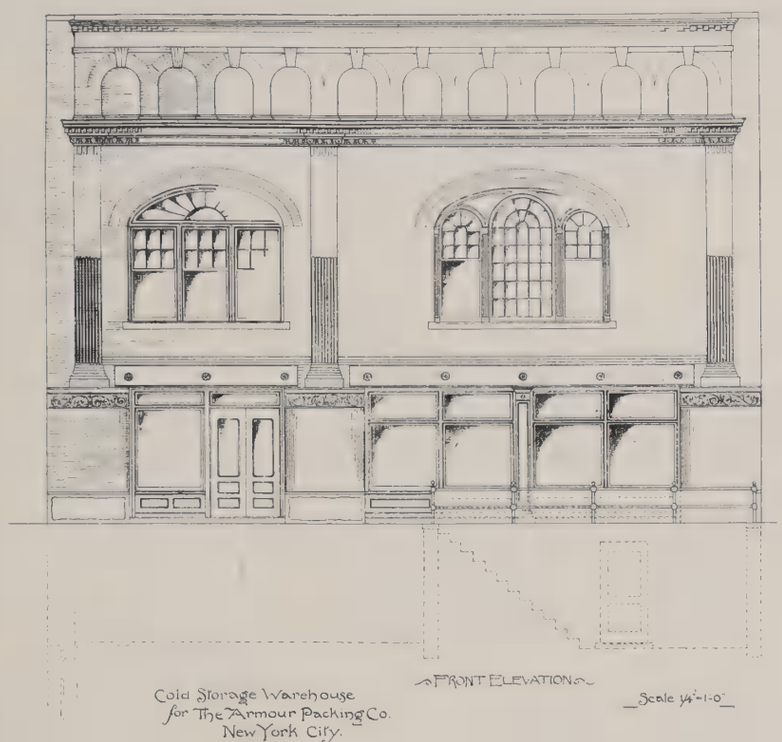
HERE we have it—at last. A Pittsburgh inventor, we are told, has made a gas of ammonia and steam, which will freeze a pail of water in a few minutes. "It will probably do away with lake ice cutting," says the "unprejudiced investigator," "and revolutionize the refrigerating business. The process is so simple that a baby might operate it." This is an even greater invention than the Universal's "refrigerine salts" which required a full-fledged "hired girl" to operate it.

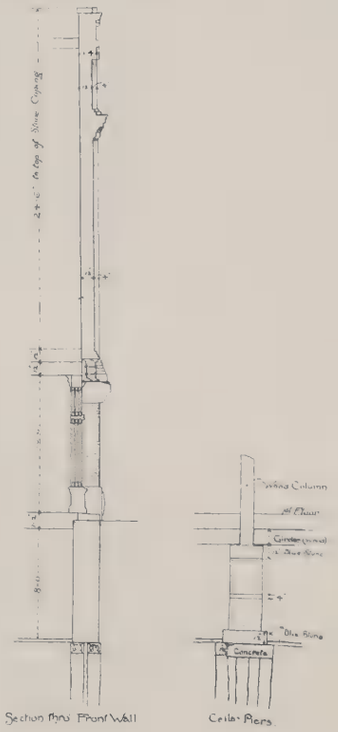
OUR notes addressed to ice dealers, asking for price lists, have been freely responded to. The invitation is, of course, also extended to all those who were not addressed by letter direct to send in their cards of rates for the benefit of the trade.

A NEW COLD STORAGE HOUSE.

THE RECENTLY ERECTED MEAT STORAGE HOUSE FOR THE ARMOUR PACKING CO., OF KANSAS CITY, IN NEW YORK CITY. —THE CONSTRUCTION AND INSULATION.

The accompanying plates represent the elevation and ground plan of the new cold storage house recently finished in New York city, at 129th street and Twelfth avenue, for the Armour Packing Co., of Kansas City, Mo., which will be used for the storage of fresh beef, pork, mutton, etc. The building has a frontage of fifty-three feet on Twelfth avenue, and a depth of seventy-eight feet to New York Central R. R. It is two stories high and has a finished basement. The front is of Philadelphia pressed brick, laid in red mortar, with Lake Superior red stone trimmings; cornice and jambs of molded brick. All other walls are of common brick laid in cement, making a solid building, resting on spruce piles driven to a solid bottom.





This house is insulated with "P. & B." paper and air spaces, no sawdust or charcoal products or other filling being used; and is absolutely dry. The floor between the ice chamber and storage room is insulated in the same manner as the walls to within a short distance of walls, and is covered with a galvanized floor. By the peculiar manner of laying this floor it never leaks.

The circulation is the main feature, and is perfect. This is brought about by the shape of the overhead work, and is not confined to what is known as ice refrigeration, but is an advantage to both the machine and the ice systems. A very material saving of ice is represented by this plan, as also a most thorough refrigeration of merchandise, the perfect circulation removing all gases from the storage room.

Where ice is used for cooling, only a sufficient amount is exposed to cool the room below without salt; and this house will maintain a uniform temperature of 34° to 37° and give better results than is possible at 34° without circulation. Where a machine is to be used, the loft, or ice chamber, is used in connection with the machine. Indeed, this house was built with a view to machine refrigeration if desired, at any future time, without increasing the cost of the building. More than 200 men, 300,000 brick, 200,000 feet of lumber and two tons of nails where used in the construction of the building, which was pushed to a speedy completion under the personal supervision of A. W. Black, the patentee, of St. Louis, Mo., and is a plant highly creditable to him.



THE Vicksburg *Herald* makes the following record of an unusual but well attested phenomenon, reported by a fruit growing subscriber: "Though the thermometer registered but 33° at the signal station, there was ice thicker than a knife blade on the glass of my pit March 2, occasioned doubtless by the gradual condensation of the atmosphere by the cold glass, which readily froze as it trickled to the lower edge. It is to be feared that such low temperature will injure the too progressive fruit trees."

NEW COLD STORAGE PLANTS.

The fruit growers around Omaha, Neb., are trying to get cold storage facilities for fruit and vegetables in that city. It seems remarkable that in a city of that size and importance, such facilities as they want do not already exist. At the last meeting of the growers, there were two propositions made: One that the growers erect a house to cost $35,000, which one gentleman offered to rent and operate, paying a rental for five years of 3 per cent first two years, 4 per cent for the third, and 5 per cent for the fifth year; while another made an offer of $2,000 per year for the five years. The matter, however, was left in the hands of W. L. Davenport, who said he had found a man who might be induced to build the house on his own account.

The record of new plants, etc., is as follows:

ARKANSAS.

Hot Springs—The storage house for dressed meat erected here by A. W. Black, of St. Louis, for the Armour Packing Co., of Kansas City, at a cost of $18,000 is finished, and doing business.

FLORIDA.

South Jacksonville—The Oak Terrace Cold Storage Co., capital, $25,000, has been organized by T. H. Butler, J. W. Faggerty and W. T. Chapin, to build a cold storage house and ice factory.

ILLINOIS.

Chicago—The Consumers' Ice Co. will erect a cold storage addition to their ice plant at Butler and Thirty-sixth streets, 90 × 115 feet, four stories high, costing, completed, $80,000.

Minonk—The well known produce firm of Priebe & Simater, with houses at Peoria and Minonk, Ill., have contracted with the Wickes Refrigerator Co. for a freezing room and a cold storage room in their building at Minonk. These rooms have a capacity of about three car loads each.

IOWA.

Council Bluffs—The Merchants' and Manufacturers' Association and the Board of Trade are discussing the erection of a cold storage warehouse. A similar house is talked of in Omaha.

KENTUCKY.

Cave City—Davis & Rankin, of Chicago, will erect a creamery here for a new stock company just organized.

MICHIGAN.

Sault Ste. Marie—The Hammond-Standish Co. are building a cold storage house.

MINNESOTA.

Delano—The Delano Produce Co. have built a refrigerator. They handle country produce.

NEBRASKA.

Kearney—Geo. Keek & Co. have procured a building which is being turned into a cold storage warehouse. The ice box, when completed, will hold 3,000 tons of ice. The building measures 40 × 120 feet, and will have a capacity of thirteen car loads. It is understood that they will make a specialty of handling butter and eggs.

NEW YORK.

New York—A. W. Black, of St. Louis, has just finished the erection here of a $30,000 storage house for dressed meat for the Armour Packing Co., of Kansas City, using the Black system throughout.

Utica—The Utica Cold Storage and Warehouse Co. has filed a certificate of incorporation to carry on the business of cold storage and warehousing; capital stock, $30,000; directors for the first year, Edward J. Millspaugh, Merrick Freeman, George W. Pixley, all of Utica; Albert S. Brinckerhoff, of Fishkill, and Douglas M. Green, of Syracuse.

York—E. C. Eldridge will build a cold storage house here

OREGON.

Cleone—The contract for the erection of the refrigerator building will be let soon.

PENNSYLVANIA.

Reading—The Reading Cold Storage Co., C. D. Guldin, president, will have 200,000 cubic feet of storage room, and ice making capacity of seventy-five tons. They will set up three 35-ton machines. The new plant will be located on the corner of Reade and Elm streets, on the Reading road. The buildings will be substantial brick structures. The refrigerating machines are of the "consolidated" pattern, furnished by Jos. Koenigsberg, New York, and built by the De La Vergne company, and are not "De La Vergne" machines, as previously stated.

TENNESSEE.

Hill City—Moon & Plumley will erect a large refrigerator here.

Nashville—The Nashville Creamery Co. will put in a 4 or 5-ton refrigerating machine, and are in the market.

WASHINGTON.

Seattle—The Seattle Automatic Refrigerating Co. has just completed an enlargement of their cold storage capacity, giving them for the season 75,000 cubic feet. Negotiations are also pending for the laying of their pipe line refrigerating system through the different streets and alleys of the city.

Seattle—The Citizens' Market Co. has been incorporated by F. A. Allen, Geo. M. S. Doren, J. E. Peterson, J. J. Akin and J. W. Dodge; capital, $50,000. Their object is to open a central market, rent stalls, and store produce. The Seattle Automatic Refrigerating Co. will lay a pipe line to their store room very soon to refrigerate the entire market house.

WISCONSIN.

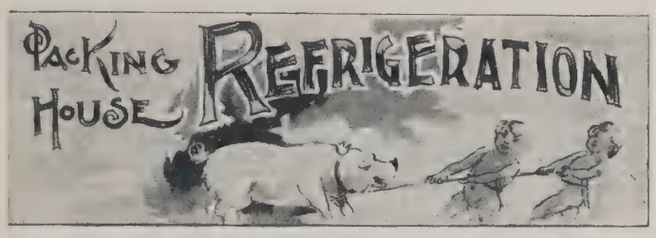
Milwaukee—A new company, known as the Milwaukee Market and Cold Storage Co., capital, $250,000, has opened stock subscription books in that city. It is proposed to locate the building on Market street, from Juneau avenue to Knapp street. All the stock has been subscribed except $75,000. The Wisconson Trust Co. and F. W. Montgomery, 86 Michigan street, have the matter in hand.

COLD STORAGE OF ORANGES.

At a recent meeting of orange growers, at Jacksonville, Fla., J. B. Briggs, of Russellville, Ky., said that, recognizing the desirability of storing oranges and thus withholding shipments until the regular marketing season had passed, he had made a study of the subject, and "found that in order to keep oranges a long while it is necessary to store them where the air is cool and dry. It occurred to him that these are the characteristic qualities of the air found in the caves of Kentucky. In the Mammoth cave, for example, the temperature is about 52° the year round, and the air is so dry that the remnants of the old wooden niter vats seem to be almost imperishable. Acting on the suggestion, Mr. Briggs said he had placed a quantity of oranges and lemons in two caves, one of which has a temperature of 49° and is large enough to hold several million boxes of oranges. In these caves he has kept oranges in perfect condition for sixteen months, and lemons for a year."

Mr. Briggs, says a commentator on his statement, "deserves as much credit for discovering this method of storage as if it had never been practiced elsewhere in the world. That it is in use in Sicily is proved by a letter from Wallace S. Jones, for many years and until recently the United States consul at Messina. In a letter from him dated November 8, 1886, and addressed to the *Florida Farmer and Fruit Grower*, occurs the following statement: 'The fine large oranges that bring good prices in Palermo in summer are allowed to remain on the trees until the end of May, when they are stored in subterranean grottoes. In the sides of the mountains near Palermo are many grottoes that are cool and well ventilated, in which oranges are kept nicely during the summer. They are spread two different layers deep upon large mats placed at convenient distances one above the other. Every day or two the fruit is turned over and all the defective ones are removed. This fruit finds a home market.'"

Now, as caves are generally a scarce phenomenon in the orange growing districts of America, it seems strange that the suggestion was not made by Mr. Briggs or his learned commentator that the same results could be obtained by cold storage, facilities for which are not so infrequent as Mammoth caves. There is no reason in the world why "caves" cannot be made to order all through the orange groves of the south, and every advantage of cold, dry storage obtained at a very low cost.



There seems to be more than usual activity in packing house construction, and as will be seen by our notes below a great deal of work is laid out for the approaching building season, particularly at Omaha, Kansas City, Louisville and Indianapolis, while in several of the minor towns of the west some large houses are planned for building this season. Confidence in America's ability to produce meat for the world is strong since the inauguration of the meat inspection system, which is being rapidly extended to the minor packing houses.

At Louisville a fight is on between John Cudahy and the Bourbon Stock Yards Co., which may end in the creation of new yards around Mr. Cudahy's new packing house in that city.

At Milwaukee citizens of the immediate neighborhood are trying to induce the council to cause the removal of the packing houses from their present location in the Menominee valley, on account of the "smells" engendered by the works; but the business men's association have come to the relief of the packers by a protest against the destruction of an industry so important to the city.

PACKING HOUSE NOTES.

——Work has begun on the Nuckolls packing house at Pueblo, Colo.

——Swift & Co. will erect a cold storage plant for meat at Sheboygan, Wis.

——The plant of the Geo. H. Hammond Packing Co., Omaha, is to be enlarged.

——Seltzer Bros., the Jalappa, Pa., pork packers, are about to build a new cold storage building 60×100 feet.

——The Frederick City Packing Co., Frederick, Md., will erect two new buildings and put in new machinery.

——The Armour Beef Co., of Chicago, is to put up a four-story brick building at Meriden, Conn., beginning work April 1.

——Messrs. Russ & Sons' pork packery at Eureka, Cal., was burned March 4, with 1,000 bbls. of pork; loss, $10,000; insured for $4,000.

——A packing establishment costing, including the grounds, switching facilities, etc., more than $100,000, is to be built at Pueblo, Colo., at once.

——Fire on March 11 destroyed the slaughter and packing house of the Danahy Packing Co., East Buffalo. Loss estimated at $25,000, covered by insurance.

——The Claremont Abattoir Co., of Claremont, Md., has been incorporated with a capital stock of $300,000, for the purpose of slaughtering and dealing in cattle.

——Over $175,000 will be spent this season on the stock yards and packing houses at St. Joseph, Mo. A mortgage of $176,500 on the stock yards has been paid.

——The Morrell Packing Co., Ottumwa, Iowa, will have a corps of government meat inspectors located at their works in order to take advantage of the export law.

——Velasco, Tex., is making an effort to secure the establishment of a packing house with cold storage facilities. Velasco is a new "gulf port" with boom proclivities.

——The Kingan Packing Co. has broken ground for the addition to the Kansas City, Mo., plant at Armourdale. The company will also build at East St. Louis, Ill.

——The G. F. Swift & Co. Packing Co., of Omaha, will put $150,000 into a new building there this spring, to be 64×193 feet, six stories high, including cold storage on two floors.

——The Hercules Iron Works has just put in a 60-ton refrigerating plant for the St. Joseph, Mo., stock yards, which will have a daily capacity for the refrigeration of 800 hogs.

——James M. Ryan, packer, Galena, Ill., is increasing his facilities by putting in a 20-ton refrigerating machine, for which he has contracted with the Hercules Iron Works of Chicago.

——John C. Hatley, packer at Chicago, has contracted with the Hercules Iron Works for an 80-ton refrigerating machine, which is to be placed in the Union Stock Yards within the next month.

——W. P. Ijams, president of the belt road and stock yards company of Indianapolis, Ind., has been authorized by the directors to erect buildings for a pork house, the estimated cost of which is $75,000.

——Improvements at the Cudahy Packing Co.'s plant, Omaha, will cost $250,000. Six new buildings, to cover an area of three and one-half acres, will be built, including butterine factory, fertilizer department, etc.

——Land has been purchased by the Union Stock Yards Co. for erecting a packing house at Nashville, Tenn., but as the location is in close proximity to Fiske University serious objection will be made to its completion on the site selected.

——It is said that a new slaughter house and refrigerator will soon be constructed on Colerain avenue, Cumminsville, Cincinnati. The names of Caleb Dodsworth, the distiller, and John Miller, the butcher, are used in connection with the enterprise.

——An English syndicate has opened negotiations with Coffin, Fletcher & Co., Indianapolis, for their pork house and the grounds surrounding it. The parties who want the house are government contractors furnishing meats to the British army and navy.

——The packing establishment heretofore conducted by Messrs. Wieneke & Hohenadel, at Davenport, Iowa, has passed into the control of a stock company with a capital of $50,000. This new concern is Wieneke & Hohenadel Packing Co., and the incorporators are L. F. Wieneke, P. Hohenadel, Jr., N. J. Touissant and P. Hoerr, all of whom have been heretofore connected with the establishment.

——The Dominion government has been applied to for a charter for the incorporation of the Union Stock Yards Co., with headquarters at Montreal. Those interested are Robert Bickerdike, John Crowe, Cornelius Coughlin, Michael Green and William Cunningham, all of Montreal. The capital of the company is in the neighborhood of $200,000. Three hundred and ten acres of land have been secured at Lachine.

——At Louisville, Ky., the Louisville Packing Co. will erect a building 145×280 feet, with a refrigerator storage capacity of 800 cattle and hanging room capacity of 6,000 hogs, and seven large smoke houses. The company will also put in an ice machine of 150 tons daily capacity, and a 150-horse power Corliss engine. The new improvements will cost about $150,000. John Cudahy, of Chicago, is the company's president.

——The People's Slaughter House and Refrigerating Co., of New Orleans, La., are to put up a new plant. This concern has had considerable trouble with the sanitary authorities. The recent adoption of the Anderson fertilizing drying process, manufactured by the V. D. Anderson Co., of Cleveland, Ohio, has enabled the New Orleans butchers to satisfy the authorities, as no disagreeable odors will emanate from the plant.

——The Moore Packing Co., capital stock $250,000, has been incorporated at Indianapolis. The officers are: Samuel E. Rauh, president; T. Smith Graves, vice-president; John Moyre, general manager and treasurer; George W. Hadley, secretary, and Henry Schurman, auditor. The plant will cost $75,000 and will consist of a main building of brick, four stories high and 150 feet square; slaughtering and rendering house, smoke houses, boiler rooms, etc. The plant will be fitted up with electric light, refrigeration and all the latest devices for handling pork products. It will have a daily capacity in the summer of 500 hogs, and in the winter of 1,500. The erection of the buildings will be begun at once. It is hoped to have it in operation by June 1.

——An important meeting of western packers at the office of Manager Babcock, of the Union Stock Yards in South Omaha, was held March 22, at which the entire packing interests of the Missouri river and interior Iowa and Nebraska points were represented. John S. Knox, of the Cudahy company, acted as chairman, and John H. McEwing, of Kansas City, as secretary. The main object of the meeting was to take steps to have the construction put on the inter-state law by the commission regarding rates on packing house products set aside. About two years ago the commission reduced the freight rate on live stock between Omaha and Chicago to a level with packing house rates. This the packers and stock yards people of the Missouri river country deem unfair. Their effort will be to have the ruling set aside. The matter was thoroughly discussed, and all of those present agreed that the west had a right to demand a change. An executive committee of three, consisting of James V. Mahoney, of Sioux City, John S. Knox, of Omaha, and Van Lawahan, of Kansas City, was appointed with instructions to begin work to bring about the proposed change at once. The permanent officers of the association elected are as follows: President, B. F. Nelson, Minneapolis; vice-presidents, W. H. Laird, Winona, William Irvine, Chippewa Falls; treasurer, R. L. McCormick, Hayward; directors, F. Meyerhauser, Rock Island; Alex. Stewart, Wausau; G. S. Shaw, Cloquet; S. T. McKnight, Minneapolis; W. J. Young, Jr., Clinton; G. H. Atwood, Stillwater; secretary, J. Newton Nind, Minneapolis.



The large natural ice crop seems to have had so far no effect on the construction of ice factories, which are being erected in all parts of the country. There is no special feature this month to report, however. The usual monthly record of new works, improvements, etc., is as follows:

ALABAMA.

Eufaula—The Eufaula Oil and Fertilizer Co. will put in a 10-ton ice machine.

ARIZONA.

Phœnix—S. D. Lount & Sons are setting up the new addition to their ice factory, which they had built from S. D. Lount's patents in Chicago last winter. The addition will cost $10,000.

ARKANSAS.

Texarkana—J. H. Duree, of St. Louis, is negotiating with the mayor in reference to the building of a 20-ton ice factory with cold storage facilities.

CALIFORNIA.

Riverside—The new ice factory of the National Ice Co. is nearly ready to begin making ice.

COLORADO.

Fort Collins—There is talk of building an ice factory.

DELAWARE.

Dover—The Dover Artificial Ice Manufacturing Co. have purchased a 10-ton York machine.

Georgetown—A company has been organized to manufacture ice; capacity of plant, ten to twelve tons.

DISTRICT OF COLUMBIA.

Washington—S. W. Curriden will erect a two-story addition to his ice factory.

FLORIDA.

Jacksonville—Guy R. Pride will start an ice factory.

Lakeland—P. R. McCrary, of Atlanta, Ga., will erect an ice factory in Lakeland during the coming season.

GEORGIA.

Athens—Sam. Rexinger has had his machine rebuilt by the Van Winkle Gin and Machinery Co., to make fifteen tons daily. It is now in operation.

Atlanta—The Capital Ice Co. has been incorporated by S. L'Engle, Thos. H. Harris, W. R. Crown and John Peabody; capital, $10,000.

Atlanta—The Van Winkle Gin and Machinery Co. has rebuilt for J. C. Peck & Co. a machine built by Hosmer, of Indianapolis (now out of business), which failed to make ice. With the Keeling improvements this 10-ton machine is now making fifteen tons daily.

Dalton—The Dalton Ice and Cold Storage Co. will increase the capacity of their plant by the addition of new machinery.

Rome—W. M. Towers has put in a 6-ton Keeling machine, which will be in operation by April 15.

ILLINOIS.

Cairo—The D. W. Ice Mfg. Co., of Cairo, Ill., started up March 2 for the season. Their entire plant was overhauled during January by the ice machine expert, Mr. S. B. Tainter, and put in perfect running order. Their factory is now turning out twenty-five tons of clear ice per day, twenty tons having been the largest output since the plant was put in until overhauled by Mr. Tainter.

Charleston—The machinery has begun to arrive for the new ice factory.

Chicago—The Economic Ice and Cold Storage company; capital stock, $1,000,000; incorporators, Norman Totten, John H. Londrigan and John A. Lane.

Chicago—The West Side Artificial Ice Co., capital, $100,000, has been licensed to incorporate. The promoters are Frank L. Strong, G. Wharton James and John D. Skinner.

INDIANA.

New Albany—The New Albany Ice Works Co. are making improvements on their plant, and will increase the number of employes.

KANSAS.

Pittsburgh—The Pittsburgh Ice Co. have started their new machine. The prime charge of ammonia was furnished by I. D. Fletcher, of New Orleans.

KENTUCKY.

Mayfield—The Mayfield Water and Light Co.. will put in a 10 or 12-ton ice machine at once, and will install an electric lighting plant later.

LOUISIANA.

New Orleans—The Municipal Ice Co. will soon start their new 150-ton machine, which will make their capacity 200 tons per day. The prime charge of ammonia will be furnished by I. D. Fletcher, of New Orleans.

Shreveport—The Louisiana Ice and Cold Storage Co., Adolph Busch, president, are pushing their new factory to an early completion.

MARYLAND.

Lonaconing—A stock company with Geo. Schwarzenbach, president, and Lloyd Lowndes, secretary, has been organized to erect an ice factory.

MISSISSIPPI.

Lexington—An ice factory is one of the projected improvements.

Natchez—The Natchez Ice Co. are overhauling their works to increase capacity by five tons.

Scranton—The Pascagola Ice Co. have started their new 10-ton machine. The prime charge of ammonia was furnished by I. D. Fletcher of New Orleans.

MISSOURI.

Carondelet (St. Louis)—Another boiler has been placed in the building of the Carondelet Electric Light and Power Co.

St. Louis—The St. Louis Ice Manufacturing and Storage Co. is putting in a new 35-ton ice machine, making their total capacity about seventy tons per day.

Moberly—The machinery for the new ice factory arrived February 25.

NEW JERSEY.

Asbury Park—The new ice factory will be ready to make ice by May 1; capacity, twenty tons. The plant will have cold storage rooms for the general public. They have purchased a York machine. The firm name is the Asbury Park Ice and Cold Storage Co.

Holly Beach.—F. G. Smith has purchased a 5-ton York machine for making ice.

Woodbury—Prominent citizens are organizing an ice manufacturing company with a capacity of twenty-five tons. H. B. Wilson is pushing the enterprise. They will use the Sulzer-Vogt machine.

NEW YORK.

New York—The Kings County Hygienic Ice Co. has been incorporated, with a capital of $300,000 to manufacture and sell ice, to make and supply cold air, and run refrigerating apparatus for cold storage and other purposes. The business is to be located in Gravesend. The directors are John Y. McKane, of Sheepshead Bay, William G. Pierson, of Brooklyn, S. Stryker Williamson, of the town of Gravesend, John Curren, John H. O'Rourke and Michael J. Dady, of Brooklyn, and Kenneth F. Sutherland, John A. Cook, and Richard V. B. Newton, of Coney Island.

NORTH CAROLINA.

Charlotte—Worth & Carmichael will have a 25-ton ice factory in operation by June 1.

New Berne—The additions to the New Berne Ice Co.'s plant, increasing the capacity to twenty tons, are progressing rapidly. The storage house is finished, and two 60-horse power boilers have been set up.

OHIO.

Youngstown—The Crystal Ice Co. have found excellent water for the ice factory at a depth of 140 feet.

OKLAHOMA.

Oklahoma City—Williams & Watson have started their new "Southern" machine. The ammonia was furnished by I. D. Fletcher, of New Orleans.

PENNSYLVANIA.

Philadelphia—Arrangements are being pushed by the Brinckle Bros. for the incorporation of the Pennsylvania Ice Manufacturing Co., with a capital stock of $500,000, and capacity of 250 tons per day. They intend to use the plate system of manufacturing, made by the Frick Co.

TENNESSEE.

Harriman—An ice factory company has been organized; capital, $20,000.

TEXAS.

Abilene—Is to have an ice factory.

Brenham—The Brenham Oil, Compress and Manufacturing Co. will put in a 20-ton Hercules machine for making ice and

cooling a cold storage house. They will also install an electric lighting plant.

Cisco—An ice factory is in course of erection.

Fairland—Is to have an ice factory.

Flatonia—Parish & Montgomery are overhauling the ice factory with a view to purchasing it.

Henderson—Is to have an ice factory.

Hillsboro—The new ice factory has been completed.

Houston—A. Wohlet is enlarging the capacity of his ice factory.

Navasota—Horlock & Holly are erecting a 7-ton ice factory.

Paris—A new 25-ton ice factory, costing $75,000, is in course of erection.

Velasco—The Velasco Ice Co. are erecting buildings for an ice factory. The plant will have ten tons capacity. Simpson, Hartwell & Stopple, of Houston, will superintend the erection of the machinery. Their machinery arrived early in March.

Victoria—The 15-ton ice plant will be enlarged by purchase of new machinery.

VIRGINIA.

Clifton Forge—The Clifton Forge Ice and Refrigerating Co. has been organized; J. C. Carpenter, president; F. M. Jones, secretary and general manager.

Richmond—The Transparent Ice Co. has rebuilt the factory recently burned.

WASHINGTON.

Seattle—The Seattle Automatic Refrigerating Co. have completed an ice tank for nine plates on the Leigh refrigerating plate system (patent applied for), with which they will manufacture twenty-four tons of ice daily.

ICY ITEMS.

——H. A. Orth will enter the ice business at Harrisburg, Pa.

——Geo. W. Burroughs has entered the ice trade at Lafayette, Ind.

——Holton Bros. will handle Las Vegas ice at Albuquerque, N. M., this season.

——Jos. T. Engelby has purchased the Roanoke (Va.) ice factory, paying $6,500.

——Parish & Montgomery, ice makers at Dallas, Tex., will put in an electric light plant.

——The National Ice Co., of California, will erect a bottling establishment at Visalia, Cal.

——Benj. Yates, Sugar Notch, has purchased the business of the Hanover Ice Co., Hanover, Pa.

——The Diamond Lake Ice Co., with a capital of $5,000, has been incorporated at Muskegon, Mich.

——The Galveston (Tex.) Refrigerating and Ice Co. will bore two artesian wells for their works.

——Benj. Top-Miller, of Cincinnati, has leased Capt. E. Bewley's ice factory at Bowling Green, Ky.

——Chas. Matthews and others have incorporated a new ice company at Plainfield, N. J.; capital, $350,000.

——A. J. Hammond, of Fox Lake, Wis., has purchased the ice business of the late L. M. Gray, of Coldwater, Mich.

——The Greene County Ice Co. and Rea Bros., of Coxsackie, N. Y., have sold their ice to the Natural Ice Co., of New York.

——Hoadley & Armstrong, Otter Lake, Mich., contemplate building ice houses at that place in time for the harvest of 1892–93.

——Lon. Sells has gone into the ice business on his own account at Bridgeport, W. Va., handling manufactured ice from Wheeling.

——Geo. E. Voorhees, Jr., representing the Electric Ice Co., of Morristown, N. J., has made arrangements to remove part of the plant to Asbury Park.

——The Huse-Loomis Ice Co., of St. Louis, have put their barges at Alton, Ill., and other Illinois river towns in repair to make shipments south.

——C. A. Drayton, having resigned his position as manager of the Savannah (Ga.) Crystal Ice Co., Col. G. N. Sausey has been elected to that position.

——S. S. Ellsworth & Co. have purchased the ice business of D. E. Dewey, of Penn Yan, Pa., the former being now by purchase the only firm in the trade there.

——J. & T. Hurley have purchased the three ice houses of C. T. Arkins, of Sandwich, Mich., with 3,000 tons of ice. Mr. Arkins will manage the business for the purchasers.

——Mr. Kaye, of Louisville, has purchased the ice factory of Capt. L. M. Tucker, at Columbus, Miss. Mr. K. will erect a bottling works at Columbus, to be run in connection with the factory.

——D. F. Kenly & Co., Chicago, recently galvanized ten trombone coils for ice machines, which were twelve feet long by nine and one-half feet high, to be set up in a Cincinnati ice plant, Kenly & Co. being the only galvanizers in either city able to handle the job.

——The City Ice Market is a new company incorporated at Minneapolis, Minn., by T. Guldbrandsen, Wm. A. Thies and Louis Seaman; capital, $25,000. The company will handle ice at wholesale and retail.

——The artesian well contractors at the Mobile, Ala., ice factory have obtained a better flow of water than was had at the experimental well dug at the brewery in the same city. The well is 755 feet deep and has a flow of 700 gallons per minute at a pressure of 40 pounds.

——The Wagner Lake Ice Co., of Sandusky, Ohio, has sold its Mansfield branch to the Mansfield Ice Co., Ed. Kerber, the late manager of the Wagner Lake Ice Co. at Mansfield, going to Cleveland in the interest of his company.

——The McCray Refrigerator Co. shipped three car loads of their goods in one shipment during the last week of February. They have also supplied the Illinois Deaf and Dumb Asylum, at Jacksonville, with one of their monster "Chiefs."

——The Hercules Iron Works are now placing one of their 10-ton ice making and refrigerating machines in the Groveland apartments building, South Side, Chicago. The machine will make ice daily for the tenants and refrigerate the separate cooling chambers for each suite of apartments.

——The crop at Ashland, Wis., was finally housed March 20, 30,000 tons being stored, of which 20,000 tons will be used at home. The total cut on Chequamegon bay was over 100,000 tons, the supplies going southward. Quite a number of speculators were interested in the cut this winter, who will probably be a feature in the business at Ashland hereafter, having done well thus far.

——Henry Herman Sulzer, president of the Sulzer-Vogt Machine Co., of Louisville, Ky., died March 9, at his father's home, 310 East Jacob street in that city. Mr. Sulzer had been for two years afflicted with Bright's disease, complicated with a complaint of the heart. A year ago he lost a part of the left hand by an accident, and this shock hastened his end. Mr. Sulzer was born in Louisville, Ky., in 1851.

——On Saturday, March 5, Siegel, Cooper & Co. opened their new store, corner of State and Van Buren streets, Chicago. In the basement of the building, which is most beautifully and elaborately fitted up, is a Hercules refrigerating machine which cools the drinking water, the soda water, the storage chambers for the restaurant and the meat chambers for the butcher shop, designed and erected by the Hercules Iron Works, of Chicago.

——J. R. Keeling, brother of N. R. Keeling, the ice machine inventor and builder, has leased the ice factory at La Grange, Ga., of the La Grange Ice Manufacturing Co., operating a Keeling machine, built by the Van Winkle Gin and Mach. Co. Mr. Keeling has also entered into negotiations with other operators of Keeling machines in the South for leases, offering a nice percentage on their investment for them, and hopes to control several of these factories this season.

AN IMMENSE MACHINE.

The De La Vergne Refrigerating Machine Co. are about ready to ship to St. Louis, to the Anheuser-Busch Brewing Association, the largest refrigerating machine in the world. The capacity of this machine for refrigerating, when making forty revolution per minute, is equal to the work of cooling accomplished by the melting of 500 tons of ice in twenty-four hours.

The gas cylinders are double-acting, 24 inches in diameter by 48-inch stroke. The Corliss engine is cross compound condensing 600 horse power. The steam cylinders are 32×64×48-inch. The machine is 28 feet 6 inches high, and occupies floor space of 37 feet 3 inches × 22 feet 3 inches. There are two fly wheels 14 feet 8 inches diameter.

The crank shaft is made of best selected horseshoe scrap iron, and is 15½ inches diameter, the crank cheeks being banded with wrought iron straps 2 inches thick, shrunk on. The shaft weighs 28,820 pounds. The compressor connecting rods weigh 3,400 pounds each, and the steam connecting rods weigh 3,800 pounds each. The phosphor-bronze used in the connecting rods and bearings weighed 4¼ tons in the rough. The total weight of the machine in the rough was 390,000 pounds; the finished weight will approximate 175 tons.

In response to numerous requests and inquiries from engineers and managers of plants using mechanical refrigeration desiring to inspect this monster machine prior to its shipment to St. Louis, the De La Vergne company threw open their works to the public and invited guests on Saturday, March 19, when an opportunity was offered those interested to see this great plant; and in consequence there was a continual stream of guests to and through the works all day long, the company serving a fine luncheon to such of their guests as desired refreshment.

THE BOYLE PATENTS.

In the March issue of ICE AND REFRIGERATION notice was made of the action of the De La Vergne Refrigerating Machine Co. against John Featherstone *et al.*, the question involved being the validity of the James Boyle patents on ice and refrigerating machinery. Boyle made application for patents November 24, 1875, and died three days later, and March 21, 1876, patents were issued in the name of Boyle. The De La Vergne company contended that the patents were valid, they having obtained rights therein by virtue of a contract between Boyle and Thos. L. Rankin. On the other hand, defendants contended that no patent was ever legally issued, as in no way could a patent issue to a dead man, and the issuance of a patent to Boyle, being dead, was the same as though issued in blank, in which case it would be void.

On February 29, after this paper had gone to press, Judge Blodgett, of the U. S. District Court for Northern Illinois, rendered a decision in the case, finding for the defendants. The Court holds that all patent rights exist only by virtue of the statutes, which recognize only three classes of grantees to whom a patent may issue: The inventor himself, the assignee of the inventor when the assignment is made before the issue of the patent, and the executor of the inventor, if the inventor dies before the patent is granted. Having drawn attention to the character of a patent, and shown that there must by its terms be, as grantee, a person capable of taking, the court reasons from the analogy of title deeds to lands, etc., which if issued to a dead man are void for want of a grantee *in esse*, that upon the principle established in those cases, a patent issued to a dead man is wholly inoperative.

In this case the rights conveyed by the patent as issued cannot descend to the "heirs" because, there having been no grantee *in esse*, there was no grant of rights to which the heirs, or their representatives for them, could lay claim, since such rights can only descend from a grantee actually in possession of them. And this condition is provided for by the statute, which gives to the executor of an applicant for a patent who dies before the patent is issued the right to apply for and obtain the patent sought, to be held in trust for the heirs, devisees and assigns. Therefore, on the death of James Boyle his administrator should have suggested the death to the Patent Office and taken up the prosecution of the application. The fact that on the death of James Boyle his widow made a contract with Thos. L. Rankin to prosecute the application does not help the case, since at the time of the making of this contract, she had no right to act, not being the administratrix of the estate, no one, in fact, having been appointed to administer the estate until after the patent office had allowed the patent. All subsequent proceedings, therefore, were void *ab initio* because Boyle, the grantee, was dead at the time the patent was issued. No rights under the patent could be conveyed by those who claimed under it, for it was void from the beginning, no matter what their conduct in reference to its validity may have been. The bill is dismissed for want of equity.

THE FIRE RECORD.

——The ice house of Abe Davis, St. Joseph, Mo., was burned February 27; loss, $200.

——McGuire & Frie's ice houses at Crescent, near Schenectady, N. Y., were burned March 1; no insurance.

——The ice storage warehouse of the Knickerbocker Ice Co., Philadelphia, was damaged by fire March 12; loss, $6,000; insured.

——The stables, twelve horses and the storage house of the Knickerbocker Ice Co., Philadelphia, burned March 12; loss, $75,000.

——J. E. Macuen's ice house, holding 3,000 tons of ice, at Milford, Mass., was burned March 11; estimated loss, $5,000; insurance, $2,500.

——The general store and ice house of the Scott Coal Co., Scott Haven, Pa., were burned February 20; loss, $10,000; cause, locomotive spark.

——The cold storage warehouse of Winans & Waldenaire, at Benton Harbor, Mich., was burned March 19; loss, $30,000; insurance, $18,000.

——The Denton Ice Factory, Denton, Tex., was burned February 29, by an incendiary; loss, $10,000; insurance, $4,000; indebtedness $2,500, secured by mortgage.

——Fire on March 17 badly damaged the Philadelphia, Pa., market house at Thirtieth and Market streets, the most completely equipped structure of its kind in the city. Most of the stock was saved, but the costly refrigerators and interior of the building were completely gutted. The loss is estimated at over $75,000, covered by insurance.

——The Rocky Mountain Oil Co., of which Dan P. Eells, of Cleveland, is president, and H. M. Claflin, of Cleveland, is secretary, with offices at Pueblo, Colo., and Cleveland, Ohio, and owning large oil wells in the Florence field in Colorado, is erecting an extensive paraffine plant at Overton, near Pueblo. A 60-ton Pontifex-Hendrick refrigerating machine will be furnished by the Hendrick Manufacturing Co. The Colorado Ammonia and Chemical Co., of Denver, will furnish the prime charge of aqua ammonia.

RAILWAY REFRIGERATION.

——The M. & O. railway has placed an order for 300 refrigerator cars with the Mt. Vernon (Ill.) car works. The road expects a large traffic in small fruits this spring.

——The Santa Fé road has organized the Santa Fé Fruit and Refrigerator Line, all refrigerator cars of the company being separated from the other rolling stock and operated as a distinct line. E. H. Davis, formerly commercial agent of the company at Wichita, Kan., has been appointed manager of the line.

——The special rate of 90c. per hundred pounds, made by the Transcontinental Association on citrus fruit from California to Chicago, etc., in order to hasten the movement of the frosted orange crop east, having expired by limitation on February 15, the association has refused to continue the rate, the old rate being restored.

——It is reported that a new refrigerator transportation company has been organized at Chicago, with Horace Tucker, late general freight agent of Ill. Cent. road as president and general manager. The company, so the information is, will be composed of large shippers and receivers of and dealers in foreign and native fruits at Chicago, St. Louis and Cincinnati and orange growers of Florida, etc.

MISCELLANEOUS ITEMS.

——The H. B. Franklin Packing Co., of St. Joseph, Mo., now own a special train of twenty-five refrigerator cars.

——The La Salle (Ill.) Brewing Co. is putting a 25-ton Hercules refrigerating plant in their brewery.

——The Idaho Brewing Co., Moscow, Idaho, has awarded the contract for a combined 10-ton ice and refrigerating plant for the new brewery that they are erecting.

——The Phœnix Brewery of Louisville, Ky., have about completed setting up a 110-ton refrigerating machine built by the Sulzer-Vogt Machine Co., making the second order they have placed with this firm.

——The Oil Creek Refining Works, of Titusville, Pa., has recently started its new paraffine works, for which the Hendrick Manufacturing Co. constructed one of its 15-ton Pontifex-Hendrick refrigerating machines.

——The Sulzer-Vogt Machine Co. are constructing a 50-ton refrigerating machine for the Knoxville (Tenn.) Brewing Co. being the second order of the brewery company, the first having been a 30-ton machine, set up over five years ago, the first machine ever made by the Sulzer-Vogt company.

——The Terminal Warehouse Co. have just completed a warehouse building, known as "Central Stores," which is one of the largest in the country. It covers an area of twenty-eight acres, and is located on Twenty-seventh and Twenty-eighth streets, between Eleventh and Thirteenth avenues, New York city. The building is several stories in height, with cellar, and has a capacity of 1,000,000 barrels. George B. Mallory was the engineer and architect. W. W. Rossiter is president of the company and B. H. Lane is secretary and general manager. The freezing and cold storage department has a capacity of 60,000 cubic feet and is equipped with a 60-ton Pontifex-Hendrick refrigerating machine, with brine circulating system, both furnished by the Hendrick Manufacturing Co.

VISIT VELASCO

Via the Missouri, Kansas & Texas railway, Houston, the I. & G. N., and Velasco Terminal railways. Daily passenger trains leave Houston 10:45 A. M., arriving at Velasco 2:05 P.M. For information concerning Velasco, or for routes, rates, maps or time tables of the M., K. & T. Ry., call on or address,

E. B. PARKER, Asst. Gen. Pass. Agent,
509 Chestnut street, St. Louis, Mo.
W. G. GRAHAM, Act'g G. P. and T. A.,
Parsons, Kan.

TICKETS TO TEXAS.

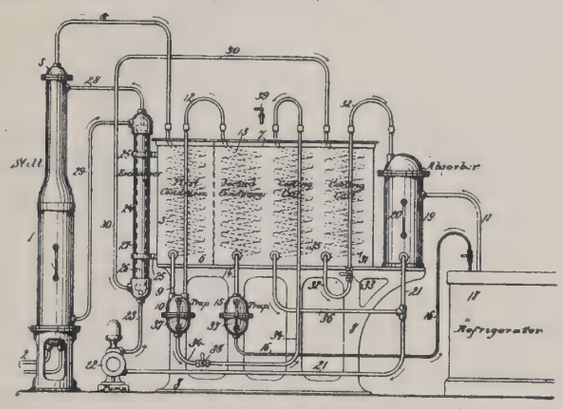
Nature has decreed that in some parts of the country, at least, it should be cold in winter, but she has generously provided for those who seek a milder climate. To the winter resorts of Texas, via Austin, Houston, San Antonio, Rockport, Corpus Christi, Galveston, Lampases, El Paso, and Deming, N. M., the Missouri, Kansas & Texas railway will, until April 30, sell at very low rates, round trip excursion tickets having a transit limit of thirty days each direction, with a final limit to return until June 1, 1892, being good to stop off at all stations in the state of Texas within the transit limit of the ticket. This road will also sell at greatly reduced rates round trip excursion tickets to California and Mexican points, limited to six months from date of sale, granting stop-overs both going and returning. For further information, call on or address,

E. B. PARKER, Asst. G. P. and T. A.,
509 Chestnut street, St. Louis, Mo.
W. G. GRAHAM, Act. G. P. and T. A.,
Parsons, Kan.



ICE MACHINE.

No. 463,958. Burchard Thoens and August Gerdes, New Orleans, La. Filed April 18, 1891. Serial No. 389,494. Patented November 24, 1891. (No model.)

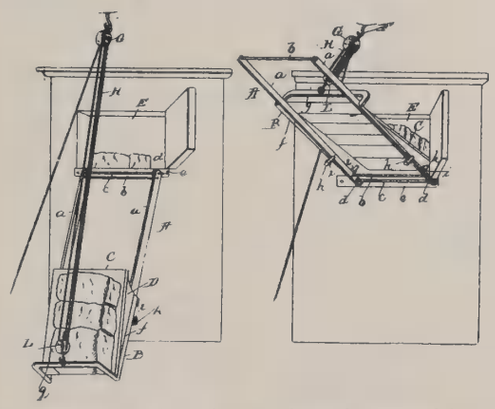


Claim.—An ice machine having two condensers maintained at different temperatures, a vessel or trap connected by a pipe to the fluid outlet of the first condenser, an absorber, and a pump to which the fluid from the absorber and the water from the vessel or trap are drawn through a single suction pipe, substantially as described.

ICE ELEVATOR.

No. 464,259. John J. Stein, Lewisburg, Pa. Filed April 13, 1891. Serial No. 388,808. Patented December 1, 1891. (No model.)

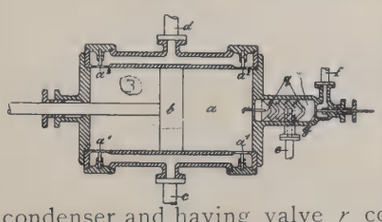
Claim.—1. The combination, in an elevating machine, of the pivoted upper section, the lower section slidably attached to said upper section, a platform mounted on said lower section, and means for raising and lowering both sections, substantially as described.



2. The combination, in an elevating machine, of the pivoted section, the sliding section mounted thereon, an inclined platform secured to said sliding section, and means attached to said sliding section for raising and lowering the same, substantially as described.

REFRIGERATING MACHINE.

No. 464,348. Paul Beck, Augsburg, Germany. Filed January 7, 1890. Serial No. 336,198. Patented December 1, 1891. (No model.) Patented in Germany November 22, 1889.

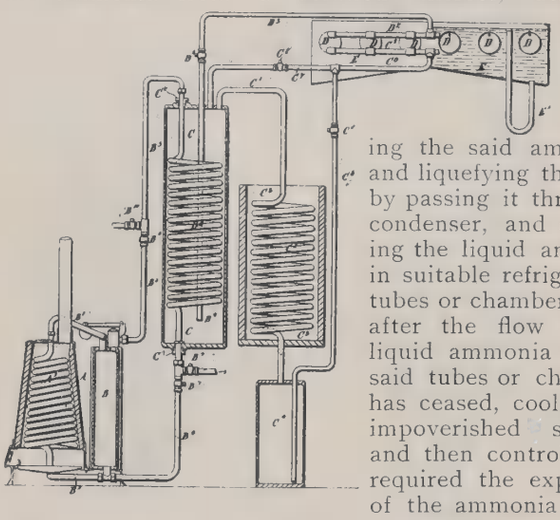


Claim.—In refrigerating machines, the combination of a chamber *s* upon the compression cylinder having pipe connections *e f* leading to the expansion coils and to the condenser and having valve *r* communicating with the compression cylinder, and a positively operated valve *g* for closing the inlet from condenser, with a separator *q*, containing cones and infundibuliform parts, or the like, said parts preventing the medium in chamber *s* from entering the compression cylinder, whereby a portion of the refrigerating medium may expand within the separator and into the compression cylinder so as to cool the refrigerating medium on its passage to the expansion coils, and also assist in driving the piston of the pump.

ICE MAKING, COOLING AND REFRIGERATING APPARATUS.

No. 464,434. Frederick B. Hill, London, England, assignor of three-fourths to James Sinclair, same place. Filed December 27, 1888. Serial No. 294,749. Patented December 1, 1891. (No model.) Patented in England December 6, 1886, No. 15,914.

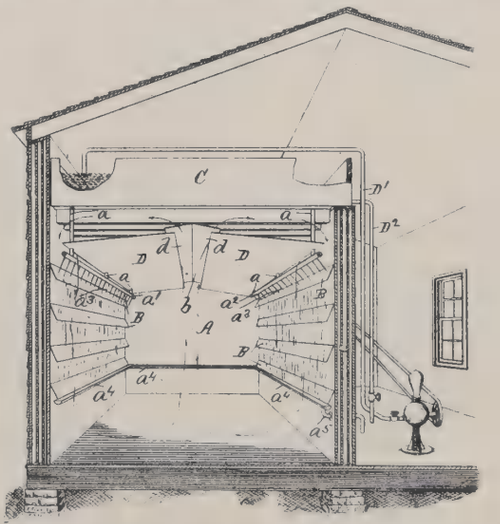
Claim.—The improved refrigerating process, consisting in first evaporating practically the whole of the ammonia from a solution thereof, dehydrating the said ammonia, and liquefying the same by passing it through a condenser, and collecting the liquid ammonia in suitable refrigerating tubes or chambers, and, after the flow of the liquid ammonia to the said tubes or chambers has ceased, cooling the impoverished solution and then controlling as required the expansion of the ammonia in the said tubes or chambers and the return of the ammoniacal gas therefrom to the said solution, substantially as and for the purpose specified.



REFRIGERATING ROOM.

No. 466,049. Daniel J. Davis, Chicago, Ill. Filed April 7, 1891. Serial No. 387,980. Patented December 29, 1891. (No model.)

Claim.—In a refrigerating room, the combination, with the inclosing walls, of a number of inclined boards arranged one above the other on two or more sides of the room, a water tank placed above the room, a number of water pipes extending downwardly therefrom, and the horizontal pipes arranged parallel with and above the first inclined boards and into which the pipes extending downwardly from the tank are inserted, said horizontal pipes being perforated and throwing a series of minute streams of water on to the inclined surfaces of the upper boards, whence the water drips down over the rest of the inclined surfaces and is conducted outside, substantially as set forth.



HINE'S ELIMINATOR.

We herewith present sectional views of the two forms in which this device is constructed. The Hine Eliminator is not new to the market; it was brought out in 1888, and several hundred of them are now in use. The exceedingly high merit it has been demonstrated to possess, both as a separator of water from live steam, as well as an extractor of oil and grease from exhaust, and the importance of such a device to ice manufacturers who desire to utilize water condensed from exhaust steam, prompts this publication. As will be seen, it is made for steam pipe running either horizontally or vertically, and by inverting the vertical form the course of the steam, be it up or down, is immaterial.

Scientific investigation has demonstrated that, to obtain complete mechanical steam separation, provision must be made for carrying the particles eliminated out of and away from the action of the steam current before they can again be taken up

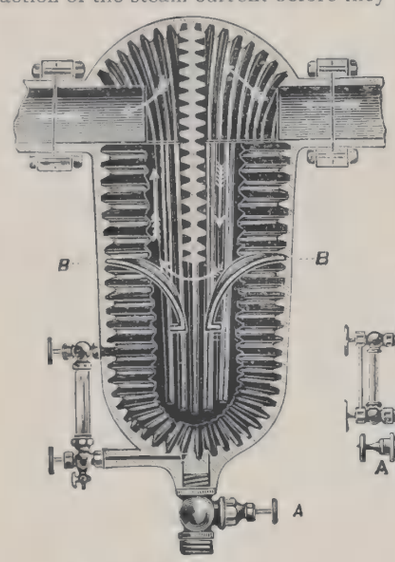


FIG. 2—HORIZONTAL.

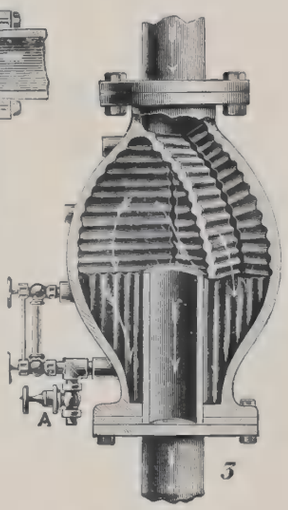


FIG. 3—VERTICAL.

by the rapidly moving steam. By reference to Fig. 2, it will be seen that the steam upon entering, as indicated by arrow courses, is driven against a transverse corrugated diaphragm extending vertically to half the length of the body, which divides the inlet from the outlet side. By contact with this diaphragm and the corrugated surfaces of the body the steam is thoroughly broken up and separation accomplished before the turning of the steam into the outlet side. At the proper aerial distance below the diaphragm are two converging disks, *B B*, between which the separated particles instantly pass into the well or chamber below, out of the steam current, from whence they are discharged through valve *A*. Steam by its elastic nature readily accommodates itself to changes of direction, while the heavier substances will pass in a direct course. It will be seen, therefore, that these particles, being at once deposited in the lower chamber out of the current, the purified steam passes under the diaphragm, thence upward and out, being deflected by an inward extending pipe at the immediate point of outlet.

Fig. 3 (vertical). At the side on one end, a currugated deflecting partition extends half the length of the body, forming the inlet. At the opposite end a vertical pipe, cast with a flange and standing out from the body, forms the outlet. The steam in passing through the deflecting partition obtains centrifugal action, and by contact with the inner corrugated surfaces is broken up; the oil, water, etc., eliminated, readily flow down the vertical corrugations and out, while the steam, diverted from its direct current, passes through the vertical pipe to point of delivery.

As a manifestation of the confidence held by the manufacturers in the efficiency of their eliminator, they will send it to any responsible party on a month's trial to be applied either as a separator of water from live steam or as an extractor of oil, grease and dirty water, from exhaust, with the understanding that if it fails to give entire satisfaction the same can be returned at their expense for freight charges both ways. Full particulars may be had from the

HINE ELIMINATOR CO., 106 Liberty St., New York.

WANTED AND FOR SALE ADVERTISEMENTS.

For Sale at a Bargain.

A new 15-ton ice or refrigerating plant, consisting of one 14x30 Corliss engine, and one 12x24 ammonia compressor; 10,000-lb. fly wheel and foundation plates. Address FRANK TOOMEY, 131 N. 3d st., Philadelphia, Pa.

Engineer Wanted.

Head engineer with experience on absorption machine for cold storage work. Must be thoroughly capable of handling engineering force and pipe fitters. Night engineer also wanted with absorption machine experience. Address, giving experience and references, "L. A. R." care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Position as Engineer.

A mechanical engineer, who is thoroughly experienced in constructing and running of ice machines (compression system) and of refrigerating plants wishes a position for office duties or for superintending the erecting and running of ice machine plants. Address "L. L. M.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago, Ill.

Ice Factory for Sale.

Ice factory company, four acres land, manager's house, two 10-ton machines, plenty water, only refrigerator in the city cooling all products, beer, etc. Or I will take a live business man on half interest, plant paying 15 per cent on $50,000. No reason for selling outside of too much other business to attend to. Address "J. J. C." care ICE AND REFRIGERATION, Chicago.

Situation as Manager or Superintendent.

Situation wanted as manager or superintendent by a practical mechanical engineer. Experienced in designing and construction of marine and stationary boilers, stand pipes, tanks, heavy plate iron work, construction of engines, pumps and heavy machinery, buying and office work. Also familiar with use of fuel oil piping, and with handling anhydrous ammonia, rigging and moving heavy machinery and making repairs. Fourteen years in charge of work. Good references. Address "Engineer" care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Business Opportunity.

A controlling or partial interest in a prosperous heavy boiler, tank and plate work manufacturing business, located at Chicago. Total investment about $100,000, more economically and eligibly located than any of its competitors. The largest and most complete plant in heavy tools in the West, in perfect order. Shops are crowded with profitable orders. Growing business. No limit to the field. Reason of selling, illness of principal officer. An excellent opportunity to get into a well established and growing business. Most thorough examination invited. Address High Grade Boiler, Care McMurdy & Job, Att'ys, Chamber of Commerce Bldg., Chicago.

E. H. COOK CO. LIMITED

ENGINEERS AND CONTRACTORS FOR

Hot Water and Steam Heating

Ventilating

ALSO ALL KINDS OF PIPING FOR

BREWERIES

WATER, STEAM AND GAS.

Greenhouse Heating & Steam Laundry Work

PUMPS

DAMPER REGULATORS, FEED WATER HEATERS, AND ALL KINDS OF ENGINEERS' SUPPLIES.

92 and 94 Andrews Street,

ROCHESTER, N. Y.

A PENNY SAVED

Is a penny earned. If your brine pipes can be made to do longer service, or your other iron work, such as condensing tanks, etc., will look better, why not use the material that will do this? which is the cheapest good black ever made. Write us for particulars. We sell to nearly every brewer and ice machine plant in Chicago, and hundreds elsewhere.

Write us for letters from users, etc.

BONNELL'S NUBIAN IRON ENAMEL

77 Warren St., NEW YORK.

THE NUBIAN IRON ENAMEL CO., 17 TO 19 NUBIAN AVENUE, (A CHICAGO SUBURB.) CRAGIN, ILL.

ATTENTION, CREAMERIES!!!

THE Alexandria Improved Jumbo Separator . .



THE ALEXANDRIA IMPROVED JUMBO SEPARATOR has the largest capacity of any machine in the world, with this size bowl, viz.: 15. With a speed of 6,500 revolutions per minute it will separate 2,500 to 3,000 lbs. per hour. Two horse power will run it. We guarantee this machine in every respect; material, workmanship and separation of cream perfect. The bowl of this separator is forged from steel made especially for this machine. If you need a large separator, call on us. We control the Nelson & Peterson and the Stephens Patent for the U. S. of the Alexandria and Jumbo Separators.

DAVIS & RANKIN BLDG. AND MFG. CO.
240 TO 254 WEST LAKE STREET, CHICAGO.

F. L. GALIGHER,

Consulting Expert

.....IN. ....

ICE AND REFRIGERATING MACHINERY

Capacity of Plants Increased
AT A MINIMUM COST.
REPAIRS AND ALTERATIONS MADE.

Perfected Distilled Water Apparatus FOR . . . ICE FACTORIES, PURE WATER COS. A SPECIALTY . . .

Manufacturers' Agent
ELECTRIC LIGHT MACHINERY, BOILERS, ENGINES, AMMONIA, ETC.

Correspondence Solicited.

Cor. Scott and Denison Streets,
GAINESVILLE, TEXAS.

J. K. KILBOURN,
Consulting Engineer,
OWNER AND BUILDER OF
THE "KILBOURN" ICE MAKING AND REFRIGERATING MACHINES
FOR SHIP AND SHORE.
942 Drexel Building, PHILADELPHIA.

A. W. SWANITZ, CONSULTING ENGINEER, AND EXPERT IN
Ice AND Refrigerating Machinery
CORRESPONDENCE SOLICITED . . .
701 STOCK EXCHANGE BUILDING,
CHICAGO.

HALL ENGINEERING CO.

DESIGNERS AND BUILDERS OF
Ice Making and Refrigerating Plants
STEAM POWER PLANTS,
ELECTRIC LIGHT AND POWER PLANTS,
WATER WORKS, GAS WORKS,
GENERAL MECHANICAL CONSTRUCTION.
N.-W. Corner 6th and Locust Streets,
ST. LOUIS, MO.

J. M. WESTERLIN. ALLAN CAMPBELL.

WESTERLIN & CAMPBELL,

Consulting Engineers and Contractors

FOR

ICE MAKING AND REFRIGERATING MACHINERY,

26 West Lake Street, Room 11,

CHICAGO.

AMMONIA FITTINGS AND ICE MACHINE SUPPLIES. PIPE WORK, REPAIRS, TESTS AND ALTERATIONS A SPECIALTY.
PLANS, SPECIFICATIONS AND ESTIMATES PROMPTLY FURNISHED.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. MCGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. MCGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission,
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

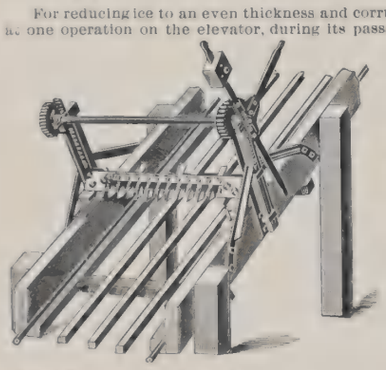
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house



It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

THE Improved Vaulting Tong



Send for Descriptive Price List.

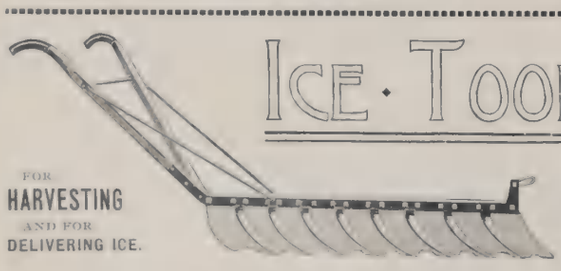
Steel Hoisting Tong
Steel Hand Tong,
Ice Axes, Ice Hooks,
Wagon Ice Runs,
Circle Ice Runs,

And all other Tools used in the Ice Business.

MANUFACTURED BY

J. G. BODENSTEIN & CO.
STAATSBURG,
Dutchess County, NEW YORK.

ICE · TOOLS

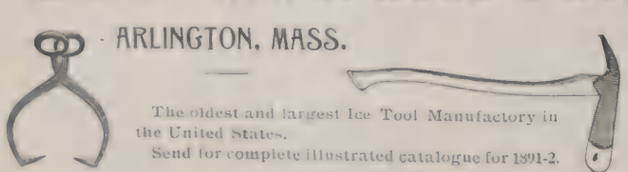


FOR HARVESTING AND FOR DELIVERING ICE.

Of Every Description.

MANUFACTURED BY WM. T. WOOD & CO.

ARLINGTON, MASS.



The oldest and largest Ice Tool Manufactory in the United States.
Send for complete illustrated catalogue for 1891-2.

DO YOU SELL ICE

IF SO . . .

ALLISON'S ICE COUPON BOOKS
ARE WHAT YOU NEED

BY THEIR USE YOU HAVE

NO DISPUTES
NO CHARGING
NO BOOK-KEEPING

Manufactured only by the

ALLISON COUPON CO.,

Free Samples, *Indianapolis, Ind.*



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

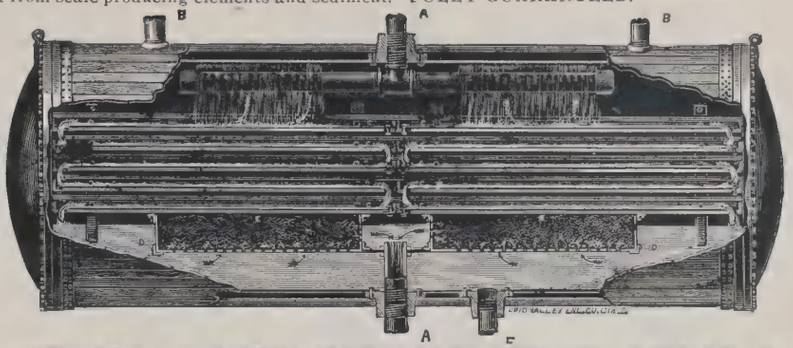
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866.....



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

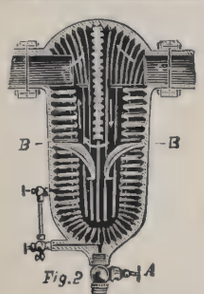
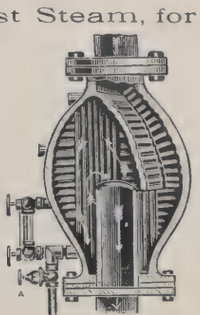


Fig. 2
HORIZONTAL.

ICE MANUFACTURERS

Desiring to use the water condensed from Exhaust Steam, for Ice Making, can do so by the use of . . . . .

Hine's Eliminator


VERTICAL.

IT EXTRACTS THE OIL, DIRT AND GREASE FROM THE STEAM, thus purifying the water of condensation. Attached to a main steam pipe will deliver DRY STEAM at any point of delivery. In a test of STEAM SEPARATORS made at Cornell University in 1891, the Hine Eliminator demonstrated its superiority over all others. For full particulars address

HINE ELIMINATOR CO., 108 LIBERTY STREET, NEW YORK.

AUG. MARITZEN,

Engineer and Architect

WILL FURNISH ON SHORT NOTICE ALL PLANS, SPECIFICATIONS AND ESTIMATES FOR COMPLETE . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE,
Chicago, Ill.

BEST OF REFERENCES FURNISHED AND SATISFACTION GUARANTEED. . . . .

IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD***, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

COLUMBUS IRON WORKS CO., MFRS. OF THE COLUMBUS IRON WORKS' IMPROVED ABSORPTION ICE MACHINE.

KEYSTONE CHEMICAL CO., Philadelphia and Chicago: COLUMBUS, GA., October 5, 1891.

Gentlemen: Our experience and practice with your Tri-Sodium Phosphate has been as follows: When commencing with the chemical, we put down a small keg of 20 gallons capacity, from which to draw boiler feed water. Above this keg we fixed another, containing a solution of Tri-Sodium Phosphate, with a valve on same arranged to allow a continuous drip of the solution into the lower keg. We evaporate about 2,000 gallons of water per day, and although taken from such a small receiver, the treatment which we give it with Tri-Sodium Phosphate, as stated, has produced the most satisfactory results. The iron oxide which discolored our ice has been entirely stopped, as is also the previous bad taste and smell in the center of block.

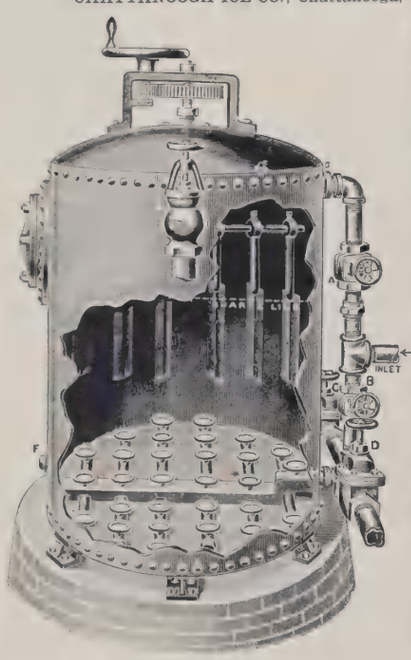
(COPY BY PERMISSION.) Respectfully yours, W. COOK, Superintendent.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST.,

CHICAGO.

REFER BY PERMISSION TO
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.

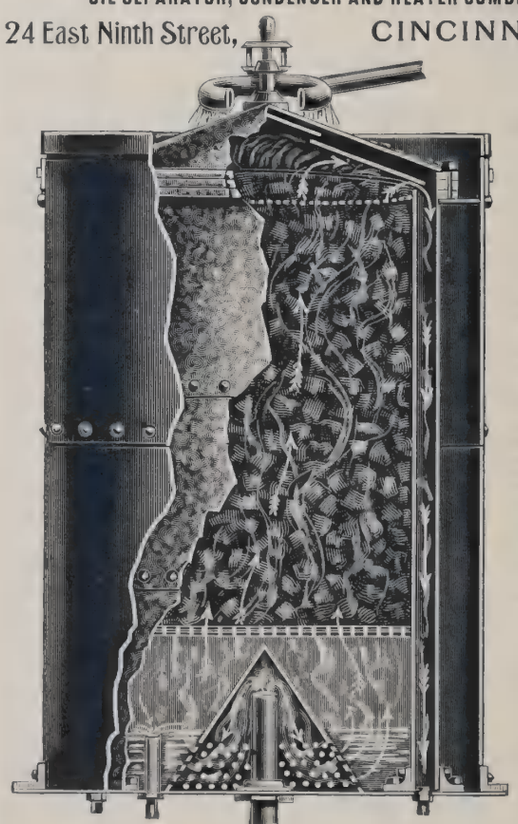
S. T. HOLMES

PATENTEE AND MANUFACTURER OF THE HOLMES

Exhaust Steam Filter

OIL SEPARATOR, CONDENSER AND HEATER COMBINED.

24 East Ninth Street, CINCINNATI, O.



OUR IMPROVED SUBMERGED CONDENSER.

CONTRACTS SOLICITED FOR COMPLETE
ICE FACTORY OUTFITS,
AMMONIA PIPE and FITTINGS,
FREEZING TANKS, ICE CANS,
TRAVELING CRANES and HOISTS,
BRINE PIPING, and
GENERAL ICE MACHINE REPAIRS

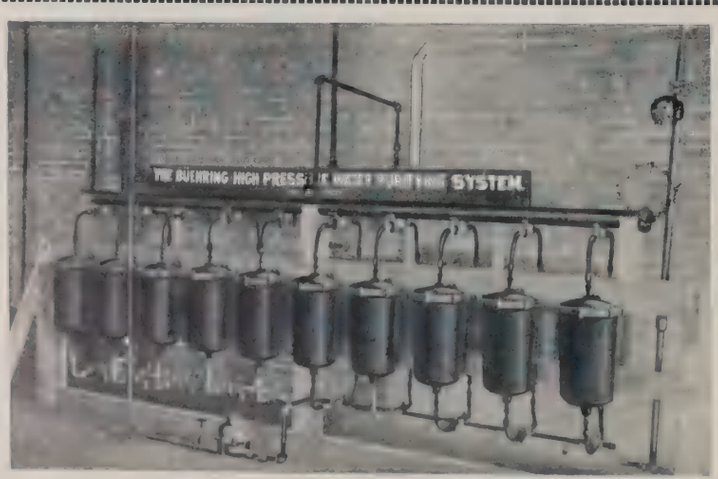
Important

TO ICE FACTORIES.

By using our system, live steam is no longer required to make up the deficiency of exhaust steam, thus a great saving in coal, wear and tear on boilers and engines.

ABUNDANCE OF WATER WITHOUT COLOR.

We make a specialty of purifying water **WITHOUT AID OF CHEMICALS** in any form whatever.



The only system that eliminates silicate, iron, bacteria, and all matter in physical solution, and is a perfect deodorizer and decolorizer. Not an improvement on any now in existence, but a distinct purifying system in itself, with no competitors.

For Particulars, References and Estimates, address

Bühring Water Purifying Co.

1389 BROADWAY,

NEW YORK.

GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.
"Phosphor Bronze"

PHOSPHOR-BRONZE
INGOTS, CASTINGS, WIRE, SHEET &c.
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND SOLE MAKERS OF "ELEPHANT BRAND" PHOSPHOR-BRONZE.

AJAX METAL CO.
PHILADELPHIA, PA.
J.G. HENDRICKSON,
F.J. CLAMER,
CO PARTNERS.

AJAX BEARINGS DON'T GET HOT.

PHOSPHOR BRONZE BEARINGS
SPECIALLY FOR
ICE MACHINES
MANUFACTURED BY
PAUL S. REEVES
PHILADELPHIA.
BRASS AND PHOS. BRONZE CASTINGS FROM ¼ LB. TO 5000 LBS. IN WEIGHT.



Ice and Refrigerating Machinery
OILS
JAS. DALZELL & SON CO. PITTSBURGH, PA.

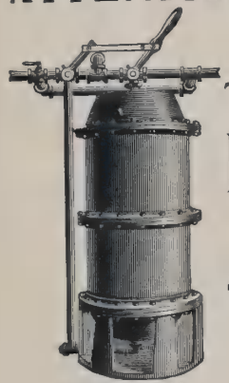
O. F. ZURN & CO.
ROYAL OILS FOR ICE AND REFRIGERATING MACHINERY A SPECIALTY.
224 N. Third St., PHILADELPHIA, PA.

The Fluoride Compound Purifies Water.
Prevents and removes incrustations in boilers.
Is economical, harmless and easy to handle.
May be kept in paper or wood indefinitely.
AMERICAN FLUORIDE CO.
126 LIBERTY STREET, NEW YORK.

GRAPHITE PIPE JOINT GREASE
SEND FOR OUR CIRCULAR.
INSTEAD OF RED LEAD.
GUARANTEED MANY TIMES BETTER.
JOS. DIXON CRUCIBLE CO
JERSEY CITY, N. J.

T. B. WRIGHT & CO.
ESTABLISHED 1824
SUCCESSORS TO CHARLES WRIGHT.
MANUFACTURERS OF.....
RE-CARBONIZED GRANULATED .·. CHARCOAL .·.
For Filtering and Artificial Ice Manufacturing
Samples and Prices sent on application.
BERLIN, N. J. Office, 117 Wood St., Philadelphia, Pa.

ATTENTION ICE MACHINE MAKERS, BREWERS AND EVERYBODY INTERESTED IN . . . .
FILTRATION OF WATER
SHOULD KNOW THAT
THE LOOMIS
Improved Water Filter
IS THE ONLY WATER FILTER WHICH CAN PERFECTLY CLEANSE ITSELF.
The Loomis Improved Filter Co.
43 S. Holliday Street, BALTIMORE.
New York Office, 111 Broadway, Trinity Building.



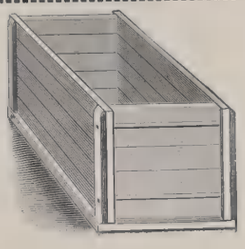
THE ONLY Perfect Water Filter.

....THE....
HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.
The great advantage of having a well located, is:
1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.
Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.
We have successfully located a large number of wells.
For particulars apply to
HEERDEGEN & SCHNEE,
48 EXCHANGE PLACE, - - - NEW YORK.



GEO. WOOLFORD,
Manufacturer of all kinds of
Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks
In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .
FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.
2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





THE CHEF.

McCray Refrigerator AND Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS OF ALL KINDS OF

REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,
Loomis Building, Clark and South Water Streets.

THE JACKSON REFRIGERATOR CO.

EXPERTS IN
ICE AND MECHANICAL REFRIGERATION.

Cold Storage Architects

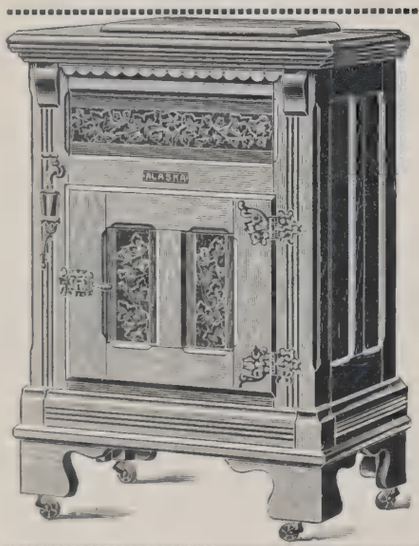
Over 300 Jackson Houses, Cooled by Ice, in Successful Operation.

PLANS AND SPECIFICATIONS FURNISHED FOR BUILDINGS AND MACHINERY.

They never become musty, and carry perishable goods longer and in better condition than any other house.

Send for "Refrigeration," a scientific treatise on Ice Refrigeration, with Circular and Testimonials.

605 RIALTO BUILDING, CHICAGO.



THE ALASKA REFRIGERATOR CO.

MUSKEGON, MICH.

WRITE FOR CATALOGUE AND PRICE LIST.
SPECIAL REFRIGERATORS MADE TO ORDER.



China Closet, Side Board and Refrigerator.
No. 36¾.

COLD STORAGE FOR FAMILY USE

THE FAMOUS LEONARD CLEANABLE IS THE ONLY PERFECT

Cold Dry Air Refrigerator

THAT HAS PERFECT CIRCULATION. **WON'T SWEAT OR MOLD.** SIX WALLS TO PROTECT THE ICE.

Housekeepers Recognize its Merits

Made in all styles and sizes, Hardwood, Antique or Sixteenth Century Finish, with air tight lock. In buying ask for "LEONARD'S CLEANABLE," and insist on having it. There is no good substitute. Send for illustrated catalogue and price list. New styles for 1892.

GRAND RAPIDS REFRIGERATOR CO.

Sole Manufacturers.

GRAND RAPIDS, MICH.

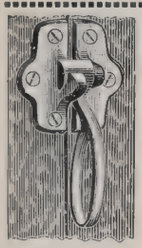
RINALD BROS.
ICE MACHINE PAINT

NON-ODOROUS
NON-EXPLOSIVE
EASILY APPLIED

Invented in Germany and used extensively throughout Europe. . . . . .

NOT AFFECTED BY STEAM, WATER, AMMONIA OR ACIDS.

SOLE MANUFACTURERS
RINALD BROS., Discount Place, PHILADELPHIA, PA.



P. J. CONROY & CO.
75th St. and Island Road,
PHILADELPHIA.

CONROY
MANUFACTURERS OF THE
Refrigerator Door Fasteners
PATENTED DECEMBER 5, 1885.

Which are rapidly supplanting all others. The only fastener that forces the door open as well as shut.

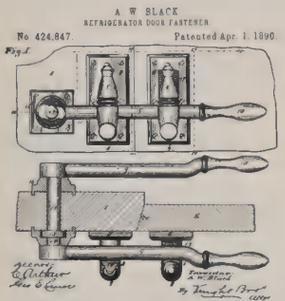
MISSOURI REFRIGERATOR MFG. CO.
MANUFACTURERS OF
The Celebrated Jewel Refrigerators

STORE AND OFFICE FIXTURES

BAR FIXTURES,
GROCERY FIXTURES,
DRUG STORE FIXTURES,
COOLING ROOMS,
BUTCHERS' SUPPLIES.

Factory and Sample Room,
No. 909 South 22d Street, ST. LOUIS, MO.

BLACK'S
LATEST IMPROVED . . .



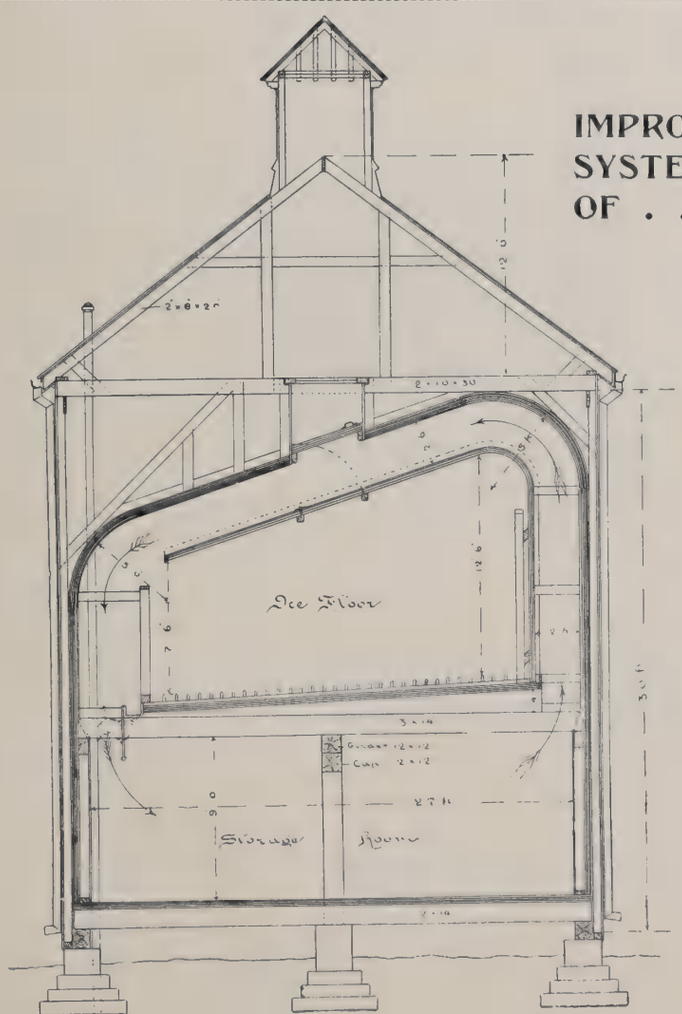
Refrigerator Door Fastener
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
PRICE, $12 BY EXPRESS, C. O. D.

A. W. BLACK, St. Louis, Mo.



BLACK'S
IMPROVED SYSTEM OF . . . .
Cold Storage
.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

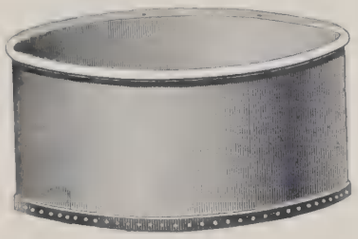
WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, St. Louis, Mo.

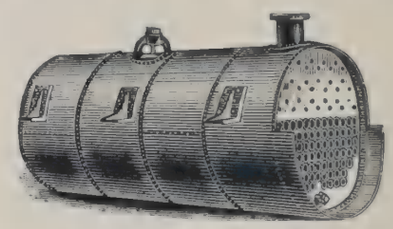
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.



MANUFACTURERS OF

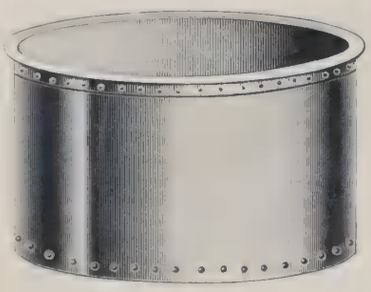
COMPOUND
CONDENSING
AUTOMATIC
ENGINES.



CORRESPONDENCE SOLICITED

BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.



WM. GRAVER TANK WORKS.

INCORPORATED

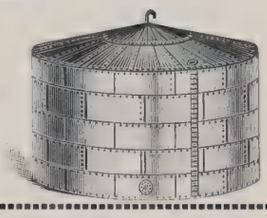
MANUFACTURERS OF .....

IRON AND STEEL **STORAGE TANKS**

WORKS:

EAST CHICAGO, IND.

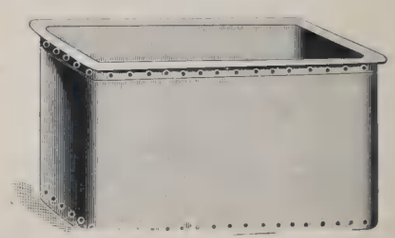
ON BELT LINE. CONNECTING WITH ALL CHICAGO RY'S.



OFFICES

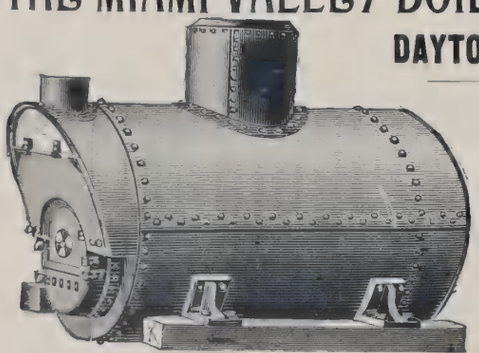
334 & 336 Rookery,

CHICAGO, ILL.



THE MIAMI VALLEY BOILER CO.

DAYTON, OHIO.



We guarantee all work to be first-class and prompt ESTIMATES GIVEN.

PLEASE ASK FOR PRICES.

BUILDERS OF

Stand Pipes, Boilers and Ice Tanks.

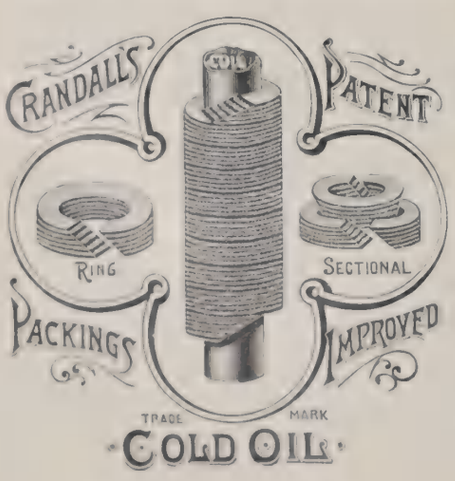
TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.



CRANDALL'S PATENT PACKINGS

FOR STEAM, WATER AND AMMONIA.

Not having been subjected to the injurious chemical action of burning oil, outlast all others, and never melt and gum. Perfect lubrication, least friction, greatest expansion, and superior durability, the verdict wherever comparative tests have been made

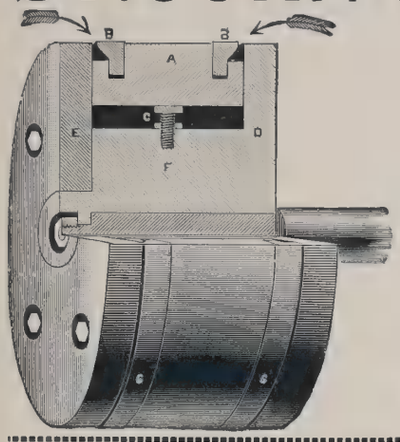
WE HOLD THE ONLY PATENTS ON COLD LUBRICATION, AND OUR GOODS ARE GUARANTEED FOR ALL PLACES WHERE PACKING IS USED.

Send for Descriptive Catalogue and Samples.

NEW YORK: 136 Liberty St.
CHICAGO: 28 S. Canal St.

CRANDALL PACKING CO.
PALMYRA, N. Y.

ST. JOHN CYLINDER PACKING CO.



MANUFACTURE A PACKING SPECIALLY ADAPTED TO ALL CLASSES AND SIZES OF . . . . . .

MARINE, LAND AND LOCOMOTIVE ENGINES, AIR COMPRESSORS, WATER, OIL AND AMMONIA PUMPS.

Insures perfectly tight pistons with minimum friction, and is self-adjusting. It increases the power of engines ten per cent, and saves fuel, oil and cost of repairs. It wears the cylinder round and true, and renders reboring unnecessary.

Highest and only awards International Exhibitions, Edinburgh and London, 1890; Special Medal of Superiority, American Institute, New York, 1888 and 1889; Massachusetts Charitable Mechanics' Association, Boston, 1890.

SEND FOR DESCRIPTIVE CIRCULARS AND PRICE LIST.

D. DeKREMEN, Sales Agent 280 Broadway, NEW YORK.



GLOBE :: PACKING

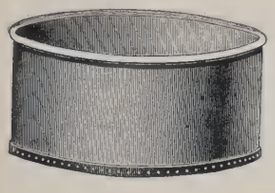
FOR REFRIGERATING AND ICE MACHINES.

THE..... BEST PACKING MADE FOR..... STEAM, WATER AND AMMONIA

None genuine without the TRADE MARK on the muslin cover. Ask your supply dealer for it or order direct.

SEND FOR SAMPLE.

Manufactured only by J. H. BILLINGTON & CO., PHILADELPHIA, PA.



THOMAS MITCHELL,

Tanks and Sheet Iron Work

FOR ICE FACTORIES, COLD STORAGES, BREWERIES, Etc.

Write for Estimates.

1711 to 1717 Main St., LOUISVILLE, KY.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES

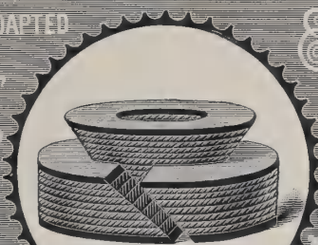


A. Chalmers, chief engineer for the Arctic Ice Co., South avenue, Allegheny, Dec. 14, 1891, wrote to Randolph Brandt as follows: "I have used the Selden's patent packing on the ammonia rods of the ice machine for the last nine years, and find it to be the best and most lasting packing I can find for ammonia rods."

RANDOLPH BRANDT, 38 Cortlandt St., New York, U. S. A.

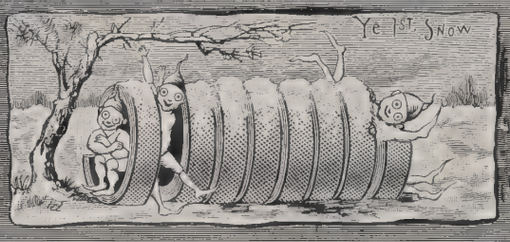
THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.



EQUALED BY NONE







PALMYRA, N.Y. ROME, GA. OMAHA, NEB.

PITTSBURGH 54 5TH AVE

NEW YORK 194 WATER ST.

CHICAGO 94 FRANKLIN ST.

PHILADELPHIA 22 & 24 N. 4TH ST.

PORTLAND, ORE.

MAIN OFFICES

AMMONIA ROD PACKING

Saves Fuel

ANTI-FRICTION METALLIC PACKING

CHEAP LASTS FOR YEARS CHEAP

Frictionless

AT LAST A PACKING HAS BEEN INVENTED THAT WILL PACK AMMONIA RODS

Satisfactorily and Economically.

ALL KINDS OF PISTON RODS PACKED.

ILLINOIS METALLIC PACKING CO.

103 TRADERS' BUILDING, CHICAGO.

Send for Price List and Description

READ WHAT ONE OF OUR CUSTOMERS SAYS.

CHICAGO, December 12, 1891.

ILLINOIS METALLIC PACKING CO., CHICAGO.

GENTLEMEN: In reply to yours of recent date, am glad to be able to state that the Ammonia Rod you packed with your Anti-Friction Metallic Packing is running very satisfactory. *After a trial of a number of other packings on this rod,* none of which were a success, I can truthfully state that I *consider your packing as being unequaled for ammonia rods, as well as for other rods, pumps and engines.* Wishing you the success you deserve with your packing, I am, Yours respectfully,

CHAS. B FAIR, Chief Engineer, CONSUMERS' PURE ICE

JAMES A. MILLER & BRO.

129 and 131 South Clinton Street,

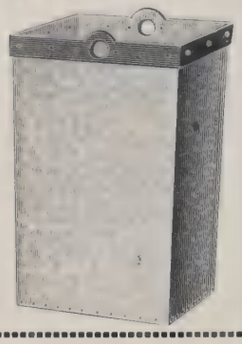
CHICAGO.

SLATE, TIN AND IRON

ROOFERS

MANUFACTURERS OF

Ice Cans



ALSO

CORRUGATED AND OTHER IRON ROOFINGS,
SHEET METAL SKYLIGHTS,
CORRUGATED CONDUCTORS, Etc.

Hair Felting

BEST INSULATOR KNOWN.

DURABLE,
CLEAN,
FIRE-PROOF.

MANUFACTURED BY

NEW YORK, PHILADELPHIA. **BAEDER, ADAMSON & CO.** BOSTON, CHICAGO.

D. F. KENLY & CO.

ICE MACHINE and BREWERS' WORK A SPECIALTY.

Galvanizers

188 & 190 NORTH UNION ST., CHICAGO.

THE CANTON STEEL ROOFING CO.

MANUFACTURERS OF

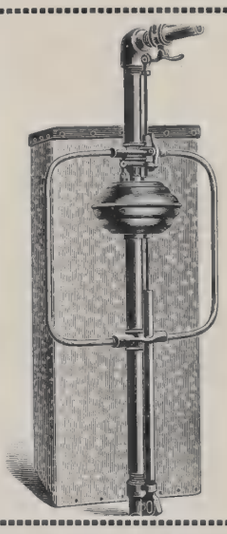


Ice Freezing Cans

RIVETLESS AND OTHER STYLES.

Insulating and Sheathing Papers,
Steel Roofing, Corrugated Iron,
Eaves Trough, Conductor, Etc.

CANTON, OHIO



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.



A. H. PEIRCE MFG. CO.

S. W. Corner Kinzie and Green Streets,

CHICAGO

WE MANUFACTURE ALL THE GALVANIZED IRON APPLIANCES USED IN ICE MAKING AND REFRIGERATING PLANTS

HEREWITH WE APPEND EXTRACT FROM A LETTER FROM ONE OF OUR CUSTOMERS . . . . . .

OFFICE OF HERCULES IRON WORKS.

A. H. PEIRCE MFG. CO. CHICAGO, January 19, 1892.

Gentlemen: * * * For three years we have bought largely from you our supply of ice cans and other galvanized iron work used in our plants, with uniform satisfaction to ourselves and our customers, and cheerfully recommend you in this instance.

* * * *

HERCULES IRON WORKS.

ESTIMATES SUBMITTED. CORRESPONDENCE INVITED .....

ICE CANS, COLD STORAGE TANKS, BRINE PIPES, FILTERS, CONDENSERS, ETC.

HILPERT & CHANDLER

ENGRAVERS
BY ALL PROCESSES.
REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.
167 DEARBORN ST. CHICAGO.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

Cor. Charles and Plum Sts.,
CINCINNATI, O.

GEIGER, FISKE & CO.

MANUFACTURERS OF



ICE CANS

According to Specifications Furnished.

Sheet Iron and Tank Work

OF EVERY DESCRIPTION, FOR

ICE MFRS., COLD STORAGES, PACKERS, BREWERIES, Etc

ALSO

Boilers, Smoke Stacks, Etc.

715 to 739 East Main Street, LOUISVILLE, KY.

Prompt Shipments

GALVANIZED SHEETS

Superior Quality

MANUFACTURERS OF REFRIGERATING APPARATUS SHOULD CORRESPOND WITH US . . . . .

WE ARE UNUSUALLY WELL PREPARED TO FILL YOUR REQUIREMENTS . . . . . .

BOX 397.

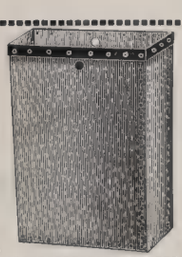
THE CINCINNATI CORRUGATING CO.

PIQUA, OHIO, U. S. A.

DUNLEVY SHEET IRON WORKS

Galvanized Iron . .

ICE CANS



And all Sheet Iron Tank Work for ICE FACTORIES.
WRITE FOR ESTIMATES.
515 NORTH LEVEE, ST. LOUIS.

WINGATE & MELL,

MANUFACTURERS OF : : :

ICE.CANS

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, ATLANTA, GA.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

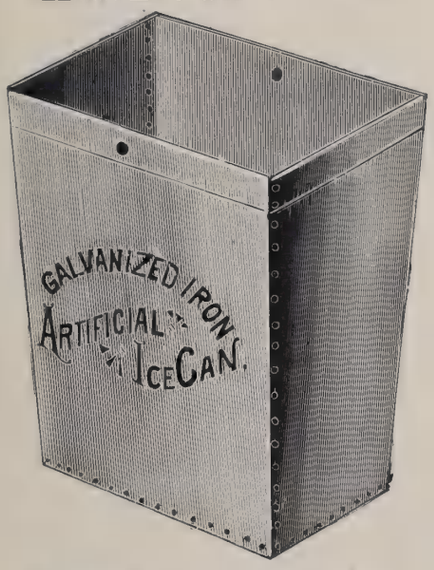
ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

ST. LOUIS, MO.

· WRITE · FOR · PRICES ·



Capacity, 300 per day.

GALVANIZED STEEL

ICE.CANS

OVER 65,000

OF OUR CANS IN USE, AND DISTRIBUTED IN 22 STATES, AS FOLLOWS:

ALABAMA
DISTRICT OF COLUMBIA
FLORIDA
GEORGIA
ILLINOIS
INDIANA
KANSAS
KENTUCKY
LOUISIANA
MISSISSIPPI
MISSOURI
NEW JERSEY
NEW YORK
NORTH CAROLINA
OHIO
OKLAHOMA TERRITORY
PENNSYLVANIA
TENNESSEE
TEXAS
VIRGINIA
WEST VIRGINIA
WISCONSIN

ESTABLISHED 1861. CHRIS. KIECHLER, PRESIDENT. INCORPORATED 1890.

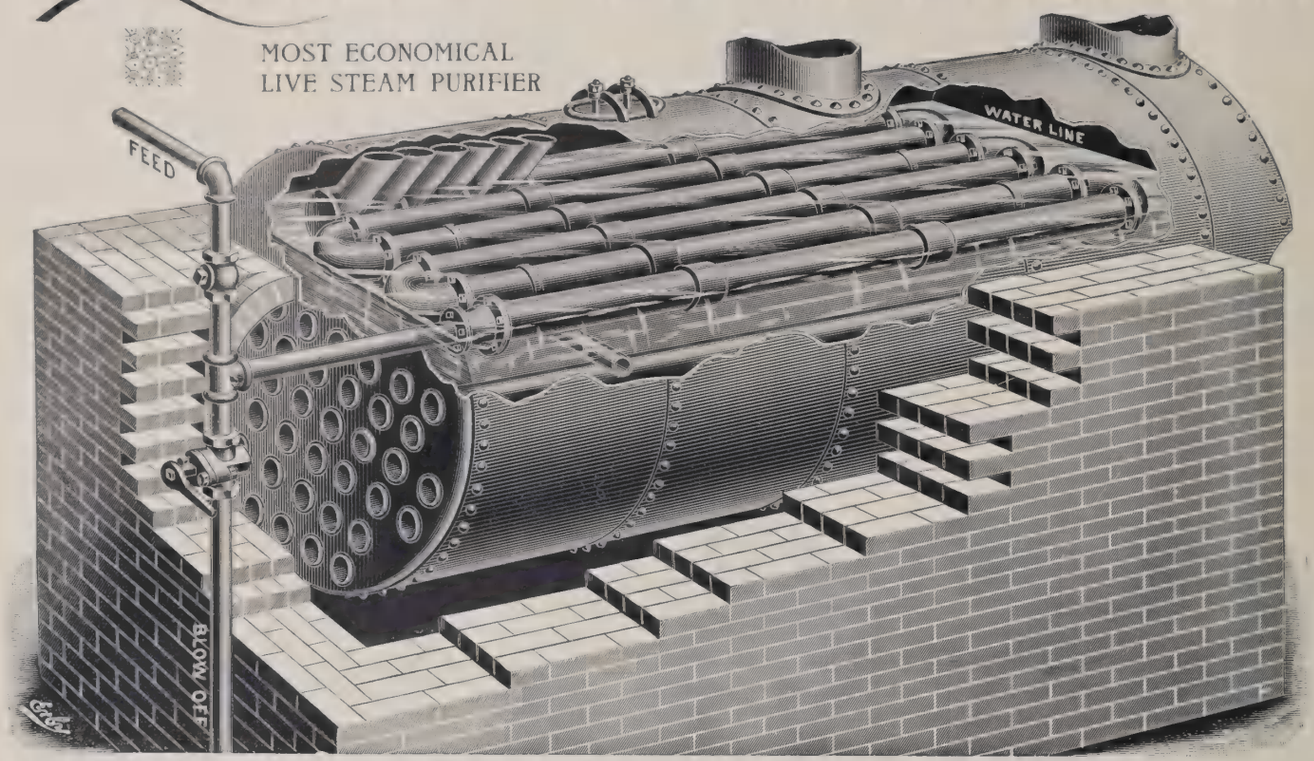
THE KIECHLER MFG. CO.

Sheet Metal Works

LINN, EVERETT AND CLINTON STS. CINCINNATI, O.

FIELD FEED WATER PURIFIER

MOST ECONOMICAL
LIVE STEAM PURIFIER



REMOVES all impurities from feed water before entering circulation of boiler. Can be *applied* in *one day*. Connection made with regular feed. Keeps boilers clean without boiler compounds. Extends period between wash outs four to ten times . . . . . .

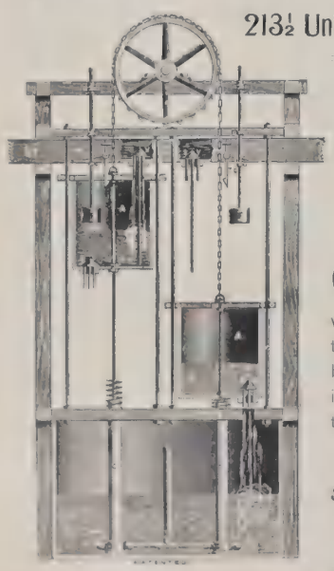
Office, 134 Van Buren Street . . .
Factory, 43d St. and Stewart Ave.

CHICAGO, ILL.

McKinlay & Garrett Hydraulic Motor Co.

HON. W. D. MAYFIELD, President.
G. P. GARRETT, Vice-President.
W. D. McKINLAY, Sec'y, Treas. and Gen'l Manager.

OFFICE,
213½ Union St., NASHVILLE, TENN.



Cheapest Water Supply On Earth

OUR motor forces any quantity of water any height or distance, without steam or labor. One hundred times cheaper than same work can be done with steam pump. Motor is self-acting, and needs no attention except oiling once a week.

...THIS MOTOR...

Substituted for steam pumps, would save many million dollars annually in U. S.

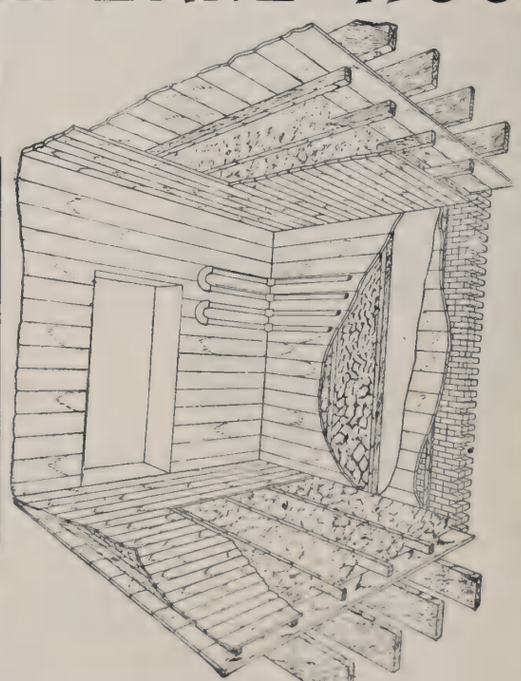
A number of machines in successful operation for nearly two years. Contracts for mineral springs, city water works, ice factories and railroad tanks a specialty. Patented all over the world. A few western states and foreign patents for sale. Send for circular. All inquiries cheerfully answered. Address

McKinlay & Garrett Hydraulic Motor Co.
213½ Union Street,
NASHVILLE, TENN.

W. D. McKINLAY,
Sec'y, Treas. and Gen'l Mgr.

MINERAL WOOL

COLD STORAGE, BREWERIES



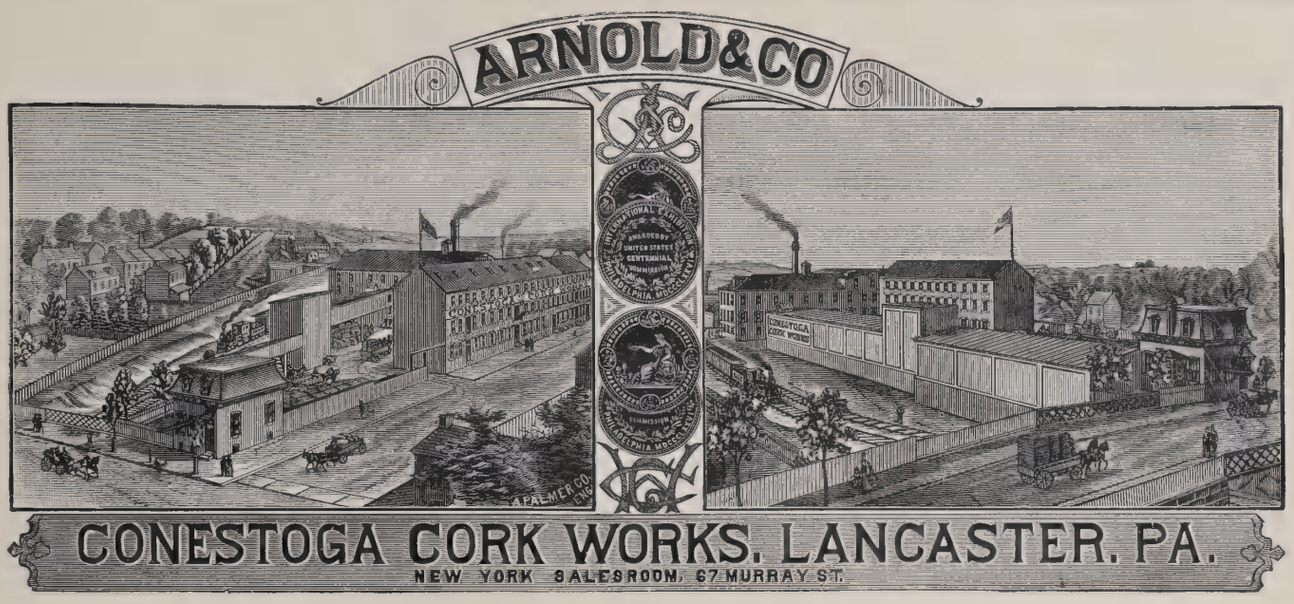
INSULATION

ICE PLANTS and REFRIGERATORS.

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.



MANUFACTURERS OF ALL KINDS OF MACHINE CUT CORKS

Granulated Cork For Insulating Purposes

Our productions were awarded the First Premium at the Great Centennial for Uniformity and Quality. . . . .

GIVE US A TRIAL ORDER AND BE CONVINCED.

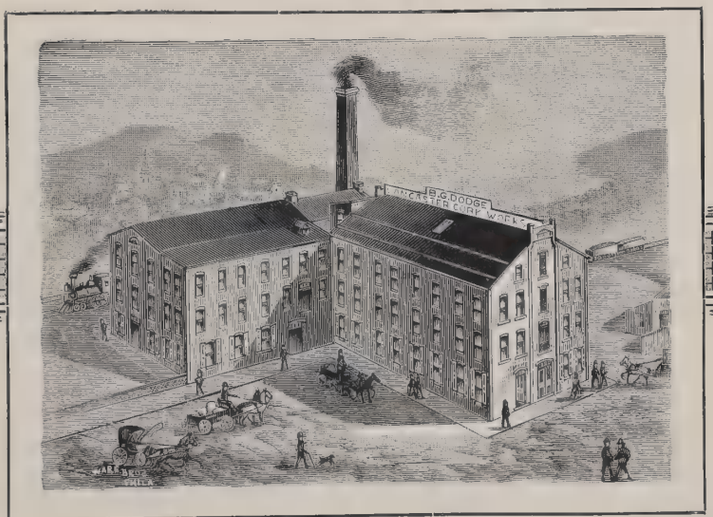
ADDRESS ALL COMMUNICATIONS TO . . . . . CONESTOGA CORK WORKS, OR TO ARNOLD & CO.

B. G. DODGE

MANUFACTURER OF EVERY DESCRIPTION OF MACHINE-CUT CORKS

FOR INSULATING PURPOSES A SPECIALTY

GRANULATED CORK



PROPRIETOR OF LANCASTER CORK WORKS

LANCASTER, PA.

ARMSTRONG, BRO. & CO.

INCORPORATED

MANUFACTURERS OF GRANULATED CORK FOR

INSULATING PURPOSES

THE MOST PERFECT AND DURABLE INSULATING MATERIAL KNOWN FOR FILLING ICE HOUSES, REFRIGERATORS, COLD STORAGES ETC.

ALSO MANUFACTURERS OF

MACHINE CUT CORKS COMPRESSED POPLAR BUNGS, PLUGS AND TAPS.

FOR PARTICULARS AND ESTIMATES ADDRESS

ARMSTRONG BROTHER & CO. INCORPORATED, PITTSBURGH, PA.
THE ARMSTRONG BROTHERS CO. NEW YORK.
FAY-ARMSTRONG CORK CO. CHICAGO.
ARMSTRONG-GILBERT CORK CO. ST. LOUIS.

BIRD'S SHEATHING

ESPECIALLY PREPARED FOR USE IN REFRIGERATORS AND COLD STORAGE

THE ONLY WATERPROOF ... INSULATING PAPER

That will not Deteriorate with Age.

SEND FOR SAMPLES AND PRICES. 149 and 151 Church Street, NEW YORK. THE BIRD PAPER MFG. CO. Phenix Building, CHICAGO

Mineral Wool

BEST INSULATOR FOR ICE HOUSES, COLD STORAGE ROOMS, ETC.

REFERENCES ON APPLICATION. SAMPLES FREE. U. S. MINERAL WOOL CO. 2 CORTLANDT ST., N. Y. CITY.

GROUND CORK

FOR INSULATING PURPOSES.

For Cold Storage Rooms, Refrigerator Cars, Brewers, and all insulating purposes. Large stock on hand which will be moved at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non-conductor of heat in all dry storage rooms and situations. They are FIRE-PROOF, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .

WRITE FOR SAMPLES AND FULL PARTICULARS ON

BEST INSULATING MATERIAL



For ∴ COLD STORAGE WAREHOUSES, AND REFRIGERATOR CARS, ICE HOUSES, AND ALL REFRIGERATION

Extensively Used and Highly Endorsed by Experts.

NEPONSET WATER-PROOF FABRICS

F. W. BIRD & SON, SOLE MANUFACTURERS, East Walpole, Mass.

S. E. BARRETT MFG. CO., CHICAGO, Western Agents.

P & B Waterproof Insulating Papers

ARE THE BEST MADE

They contain **NO TAR**, are **ODORLESS** and **CLEAN TO HANDLE**, made from the best of paper stock; used by the largest and most prominent cold storage and refrigerating plants in the **WORLD.**

P. & B. PRESERVATIVE COMPOUNDS For insulating **walls** and preserving all kinds of **iron** and **wood work** exposed to **dampness,** acids or alkalies. The material is very **penetrating,** always remains **elastic,** will not chip or peel off. **THE P. & B. No. 2. PAINT** is the **most perfect** coating for **coils, tanks,** etc.

TRADE P & B MARK REGISTERED

STANDARD PAINT CO. 2 LIBERTY STREET, NEW YORK.

Owners of **P. & B.** patents and sole manufacturers of all the **P. & B.** products.

CHICAGO OFFICE: 542 The Rookery. ∴ THE PARAFFINE PAINT CO., Manufacturers for the Pacific Coast, 111 Battery St., SAN FRANCISCO, CAL.

KEYSTONE CORK WORKS,

Granulated Cork

FOR INSULATING COLD STORAGE AND REFRIGERATOR ROOMS.

ALFRED L. BUTZ, Manufacturer of Machine-Cut Corks, 212 MARKET ST. Factory, 829, 831 & 833 N. 3d St. PHILADELPHIA, PA.

Granulated Cork

FOR INSULATING PURPOSES

THE CLEANEST AND BEST IN THE MARKET.

Send for prices and samples.

DAVID KAHNWEILER, 146, 148 and 150 Worth Street, NEW YORK CITY.

Insulating Linings

EVERY VARIETY FOR REFRIGERATORS, REFRIGERATOR CARS AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

HOWARD CARROLL, Pres. GEORGE C. CLAUSEN, Treas. C. S. CHAMBERLIN, Sec'y. HENRY BOLZE, Gen. Man.

The Sicilian Asphalt Paving Co.

THE NATURAL SICILIAN ROCK ASPHALT,

The Most Durable Asphalt Pavement for Streets.

FOR FLOORS OF BREWERIES, ICE HOUSES, CELLARS, STABLES, ETC.

THE SICILIAN ASPHALT PAVING CO. NEW YORK. EAGLE BRAND TRADE MARK ROCK ASPHALT

FOR PAVEMENTS OF YARDS, SIDEWALKS, ETC., AND FOR ROOFING.

.... SOLE LICENSEES FOR ZINSSER'S PATENT INSULATING MATERIAL FOR BREWER'S ICE HOUSES.

The best Non-Conductive known. Has been used in many Ice Houses throughout the U. S. since 1884.

REFERENCES FURNISHED ON APPLICATION. OFFICES: TIMES BUILDING, NEW YORK.

Agents for Rochester and District: THE ROCK ASPHALT PAVEMENT CO., 63 German Insurance Building, Rochester, N. Y. Agents for Dominion of Canada: THE SICILY ASPHALTUM PAVING CO., 10 to 14 Mill Street, Montreal.

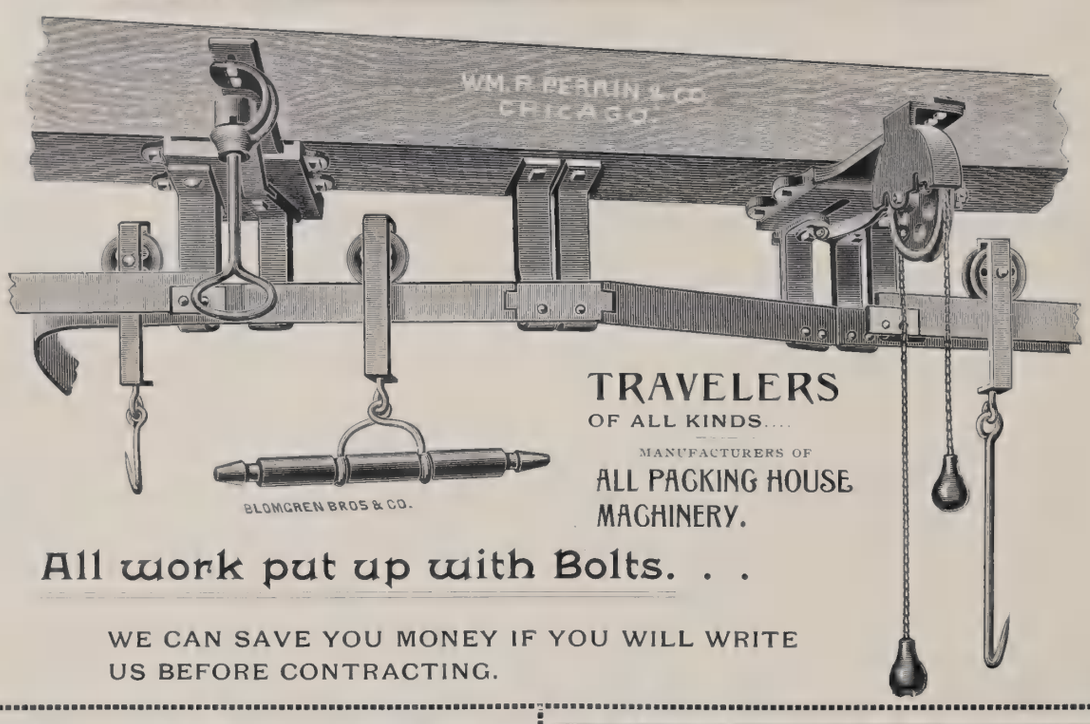
WM. R. PERRIN & CO.

CHICAGO

ALL WORK GUARANTEED

Overhead Railway

. . . 75,000 FEET OF RAIL PUT IN DURING 1891 . . .

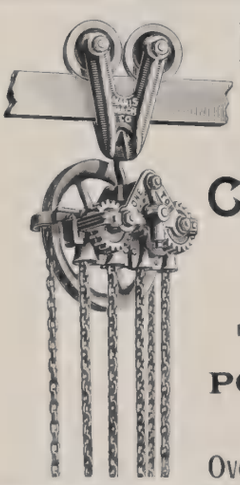


TRAVELERS
OF ALL KINDS....

MANUFACTURERS OF
ALL PACKING HOUSE MACHINERY.

All work put up with Bolts. . .

WE CAN SAVE YOU MONEY IF YOU WILL WRITE US BEFORE CONTRACTING.



MARIS MACHINE CO.

PHILADELPHIA, PA.

MANUFACTURERS OF

CRANES

POWER BRIDGE CRANES
HAND BRIDGE CRANES

FOR USE OVER FREEZING TANKS.

PORTABLE . HOISTS

Holds Load at any Point.

Overhead Track, Trolleys, Switches.

Engineers agree that our **Boiler Cleansing Compound** CANNOT BE EQUALED

(LORD'S PATENT IMPROVED)

FOR REMOVING AND PREVENTING SCALE IN STEAM BOILERS.

BOILER EXPLOSIONS PREVENTED.

Saves Fuel, Labor and Time, and prevents Corrosion in all its forms, and is guaranteed free from anything injurious to iron by the Chemists for United States Mint.



Engineers will receive free, on application, a 25c. book, "HINTS FOR STEAM USERS." Agents Wanted Everywhere. Write for Circular and Price List.

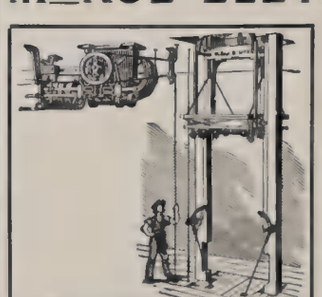
CORRESPONDENCE SOLICITED.

S. W. LORD & CO., 11 S. 9th St., Philada., Pa.



Spiral Riveted
Galvanized Iron Pipe
Sheet Brass
Brass Rods
Brass & Copper Wire
Sheet & Bar Copper
Babbitt Metal

MORSE ELEVATOR WORKS



Morse, Williams & Co.

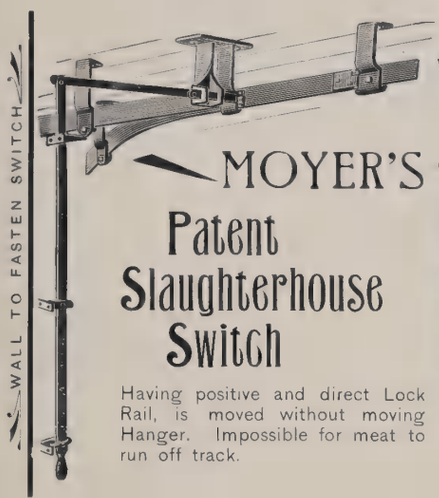
ELECTRIC, HYDRAULIC,
BELT AND HAND POWER
PASSENGER AND FREIGHT

ELEVATORS.

OFFICE, 1105 Frankford Ave. WORKS, Frankford Ave., Wildey and Shackamaxon Sts.,

PHILADELPHIA.

NEW YORK, 108 Liberty Street. BOSTON, 33 Lincoln Street.
WASHINGTON, D. C., 1116 F Street, N. W.



J. W. MOYER,

1217 Filbert Street,
PHILADELPHIA, PA.

MANUFACTURER OF

Overhead Tracking, Switches, Etc.

MOYER'S
Patent Slaughterhouse Switch

Having positive and direct Lock Rail, is moved without moving Hanger. Impossible for meat to run off track.

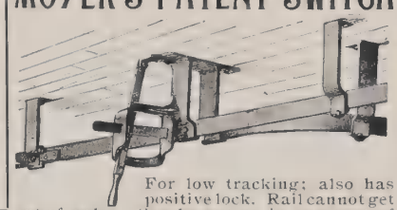


MOYER'S PATENT HANGER

Saves 50 per cent in the work of erecting tracking.

130,000
Feet of Rail
PUT UP IN 1891.

MOYER'S PATENT SWITCH



For low tracking; also has positive lock. Rail cannot get out of order. Can be put up in any part of the room.

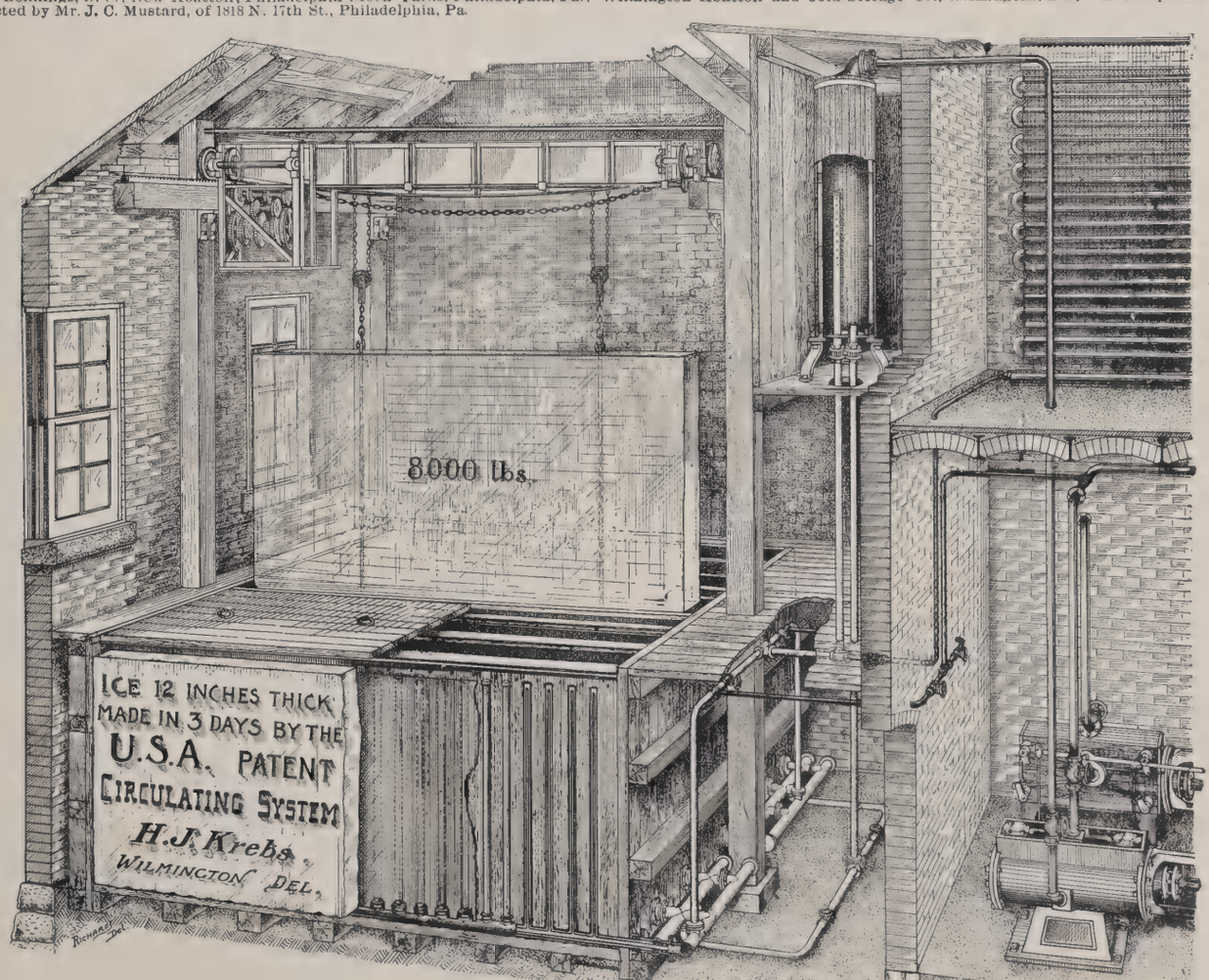
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.; Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

ROSENGARTEN & SONS.
PHILADELPHIA, PA.
Manufacturing Chemists
26° AQUA AMMONIA
FOR REFRIGERATING PURPOSES
MADE FROM SULPHATE OF AMMONIA ONLY.

RIPLEY ISINGLASS.

THE CLEVELAND ANHYDROUS AMMONIA WORKS
THOS. FLESHER, JR., Proprietor.
MANUFACTURERS OF ...PURE... Anhydrous Ammonia.
70 E. Prospect St., CLEVELAND, OHIO.

I. D. FLETCHER
ANHYDROUS AQUA SULPHATE
..AMMONIA..
GUARANTEED PUREST AND BEST
PALISADE CHEMICAL WORKS
USED BY SOME OF THE LARGEST REFRIGERATING PLANTS IN THE SOUTH WITH UNVARYING SATISFACTION.
P. O. BOX 339..... 74 Baronne Street, NEW ORLEANS, LA.

Salt for Brine FOR Ice Making and Refrigerating Machines
99½ per cent PURE SALT

If a brine is made from a salt containing lime, the lime is dissolved with the salt and held in solution by the brine; but when this brine is chilled to a low temperature, it will no longer hold the lime in solution, and it will be deposited and forms a coating of insulating substance on the inside of the pipes. This can be readily seen by examining the inside of any pipe that has been used in a brine made from an evaporated salt. This coating largely decreases the amount of heat that the cold brine is capable of drawing from the surrounding medium, and reduces the effectiveness of the plant by a considerable percentage. The cost of the extra power necessary to overcome the insulation of the coating of lime would many times pay the whole cost of a pure salt.

THE RETSOF No. 1 BRINE SALT
Is 99½ per cent chloride of sodium. It is readily dissolved, and from it a brine can be made that is practically chemically pure. This salt is used by the De La Vergne, Frick, Pictet, Arctic, Mayer, Harrisburg, and other Refrigerating Machine Companies for making the brine to start their machines.

THE RETSOF SALT MINES
Are located at RETSOF, in the central part of New York State, and from this point we have every facility for shipping in any direction. From our warehouses in *New York* and *Philadelphia*, and through our agents throughout the country, we can fill orders for less than car load quantities without delay or excessive retail prices.

FOR PRICES IN ANY QUANTITY, DELIVERED AT ANY POINT, APPLY TO
FOSTER, BROWN & CO.
. . . . 146 Broadway, NEW YORK.

HELLER, HIRSH & CO.
"ABSOLUTELY PURE"
LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA---
Furnished at short notice from the following offices, where we keep sufficient stocks constantly on hand:
240 North Front St. (Wm. Hoos, Ag't), *Philadelphia, Pa.*
65 Walnut Street (Wm. Runkle, Agent), *Cincinnati, O.*
411 East Lombard Street, *Baltimore, Md.*
Brown's Wharf, *Charleston, S. C.*
10 Pacific Avenue, *Chicago, Ill.*
MAIN OFFICE, 164 FRONT STREET,
New York.
PURITY TEST: By WYATT & SAARBACH, Directors of National Brewers' Academy and Consulting Bureau.
99.993% ANHYDROUS AMMONIA.

THE B. F. GOODRICH CO.
AKRON RUBBER WORKS, AKRON, OHIO.
MANUFACTURERS OF
MECHANICAL RUBBER GOODS
HOSE OF HIGH QUALITY
FOR ICE FACTORIES AND COLD STORAGES
Rubber Rings for Ice Machines of all Kinds,
Belting, Valves, Etc.
SPECIALTIES TO ORDER. Samples and Prices upon Application.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

B. P. CIAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE .·.

LIQUID ANHYDROUS AMMONIA

and **26° AQUA AMMONIA**

CONTAINING 29¼ PER CENT OF AMMONIA.

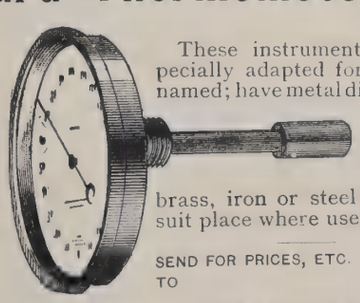
FOR REFRIGERATING PURPOSES AND THE TRADE

General Offices, 245 Broadway, NEW YORK.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



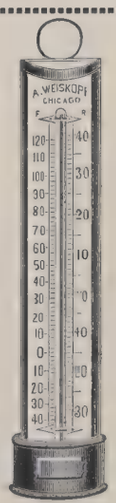
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

.....MANUFACTURER AND IMPORTER OF.....

THERMOMETERS

AND HYDROMETERS.

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.



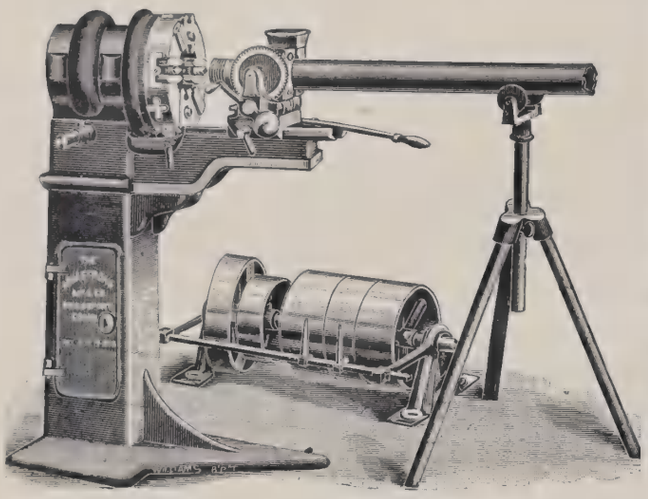
ARMSTRONG MAN'F'G. CO.



WATER GAS AND STEAM FITTERS TOOLS

CATALOGUES ON APPLICATION.

BRIDGEPORT, CONN.



Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

--- EDSON'S ---

AMMONIA RECORDERS

For Recording "Head" and "Back" Pressures.

Endorsed and Recommended

BY THE

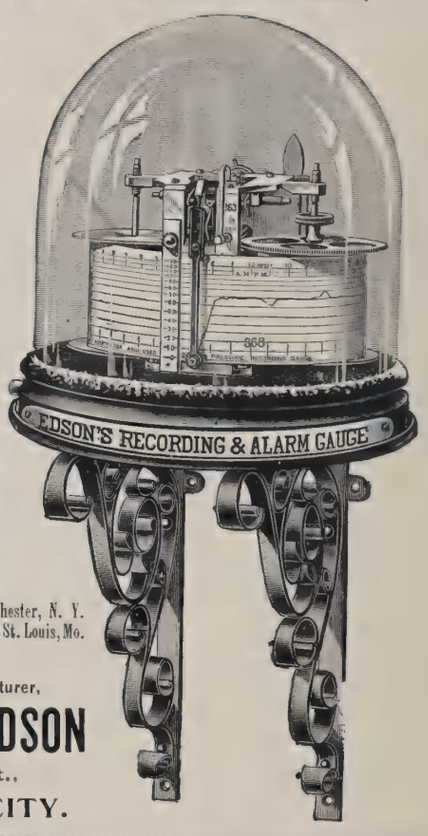
De La Vergne Refrigerating Machine Co.

As being indispensable in enabling the owner of an ice plant to keep the same in hand, and giving him thorough control over it.

I REFER

To the following patrons:

Lion Brewery . . . . . New York
Jacob Ruppert . . . . . New York
A. Hupfel's Son . . . . . New York
Consumers' Bg. Co. Ltd., New York
Long Island Brewery. . Brooklyn
J. & P. Baltz Brg. Co., Philadelphia
Wm. J. Lemp . . . . . St. Louis
Wm. Peter Bg. Co., Weehawken, N. J.
Diamond Ice Co., Wilmington, Del.
Fred Miller Brg. Co. . . Milwaukee
Bartholomay Brg. Co . . . . . Rochester, N. Y.
East St. Louis Ice & Cold Stor. Co., St. Louis, Mo.
ETC. ETC.



Address Sole Manufacturer,

JARVIS B. EDSON

87 Liberty St.,

NEW YORK CITY.

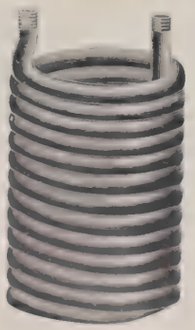
LOUISVILLE PIPE BENDING CO.





Office and Factory,
13th and Magnolia Streets,

LOUISVILLE, KY.

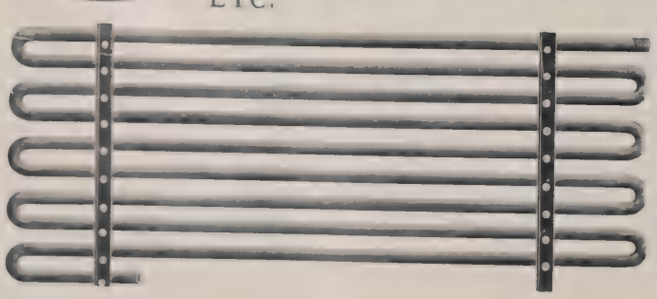


Wrought Iron Coils

IN CONTINUOUS LENGTHS, OF ANY SHAPE OR SIZE, FOR

ICE MAKING,
REFRIGERATING,
CHEMICAL APPARATUS,
ETC.







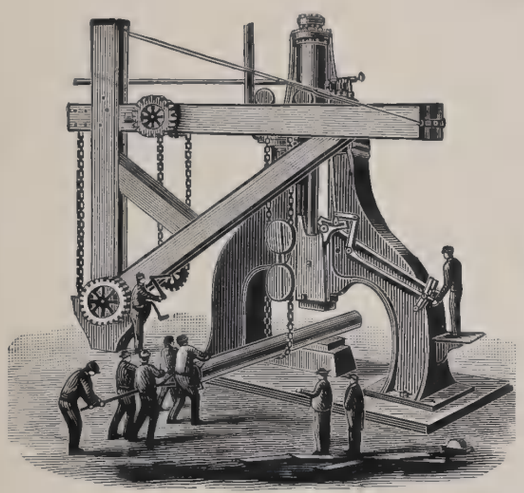
Superior facilities for turning out rapidly and accurately every description of

PIPE BENDING



ESTIMATES FURNISHED ON APPLICATION.

PIPE WELDING BY ELECTRICITY



THE SAMSON STEAM FORGE Co

OFFICE AND WORKS, CORNER Sacramento and Carroll Aves.,

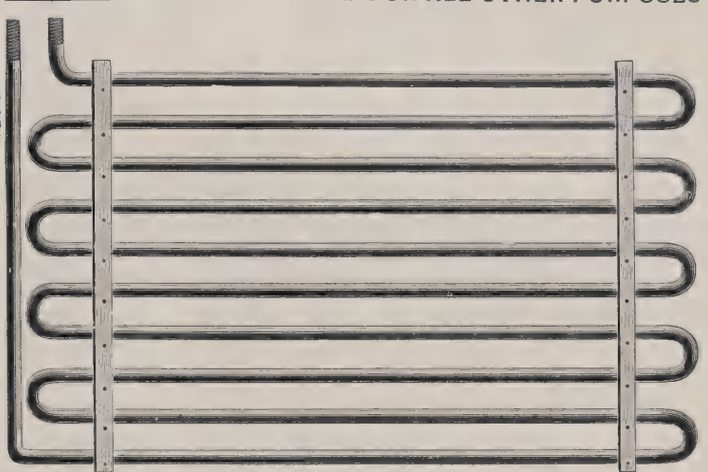
CHICAGO.

MANUFACTURERS OF

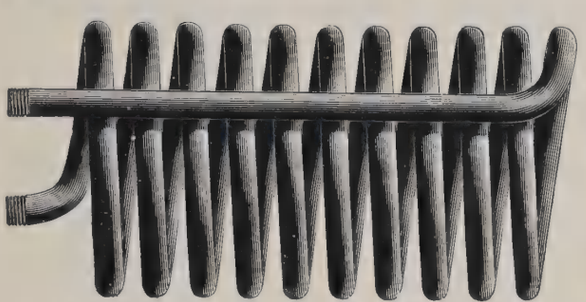
WROUGHT IRON COILS

FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES



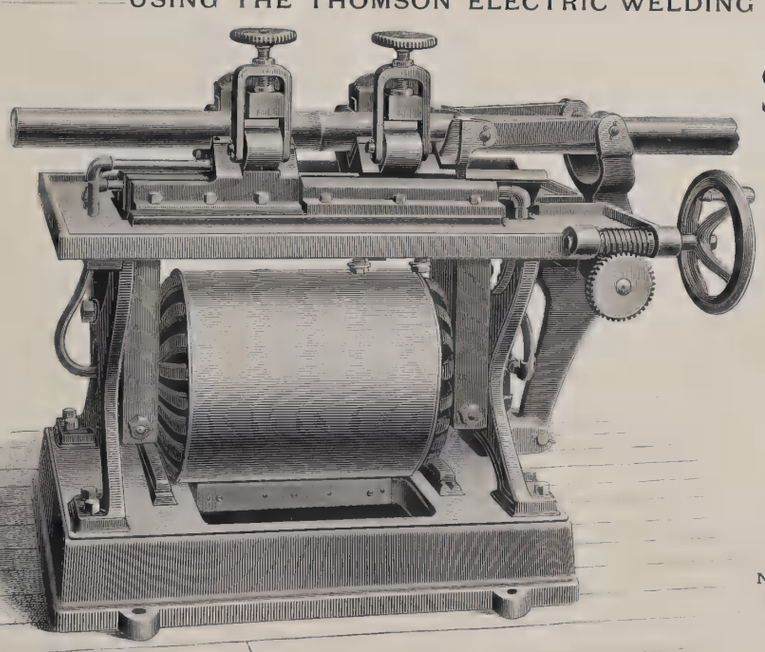
These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.



THE ELECTRIC PIPE BENDING COMPANY

OF HARRISON, N. J.

USING THE THOMSON ELECTRIC WELDING PROCESSES



Spiral Coils,
Zig-Zags,
Ovals,
Irregular
Shapes.

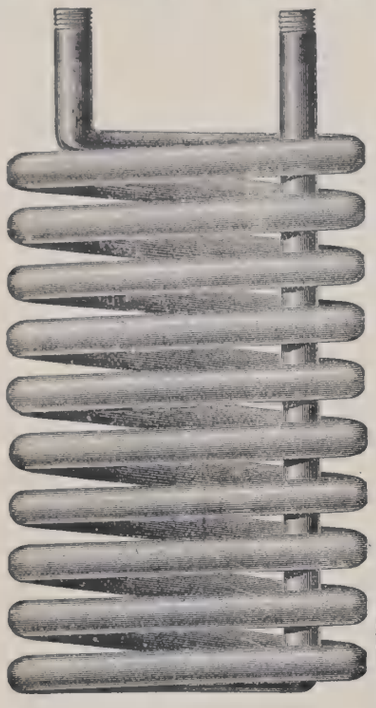
OF ANY SIZE AND LENGTH.

NO INJURY FROM OVER-HEATING. WELDS AND BENDS AS SOUND AS THE REST OF THE PIPE. ALL WORK PROMPTLY EXECUTED AND GUARANTEED.

NO BURNT OR DEFECTIVE WELDS, NO SCALE.

W. T. HILDRUP, Jr., M. E., Sec'y & Treas. J. HERVEY PATTON, Chairman. D. E. TRACY, M. E., Sup't.

THE HARRISBURG PIPE BENDING CO. LIMITED.



OFFICE, N. E. COR. HERR ST. AND PENNSYLVANIA R. R.

HARRISBURG, PA.
P. O. BOX 603.

MANUFACTURERS OF

COILS AND BENDS

Of Wrought Iron Pipe

IN ROUND, OVAL, ZIG-ZAG, SPIRAL, HELICAL, AND TAPERING FORMS,

For Ice Making and Refrigerating

COILS OF ANY REQUIRED LENGTH, AND OF LARGE SIZES OF PIPE.

Prompt Delivery Assured

IRREGULAR PIPE BENDING A SPECIALTY.



AMMONIA BOTTLE.

AMMONIA BOTTLES OR FLASKS WITH WELDED HEADS

STRAIGHT OR CONCAVE

WROUGHT IRON ANHYDROUS AMMONIA BOTTLE COCKS ANY DESIRED PATTERN.

TANK DEPARTMENT

Stills and Absorbers

FOR ABSORPTION AMMONIA ICE MACHINES . . . .

BRINE & CONDENSER TANKS

ALL SIZES

Sectional Tanks

A SPECIALTY.

These Tanks are made in flat sections, can be erected by unskilled labor, and are perfectly tight.

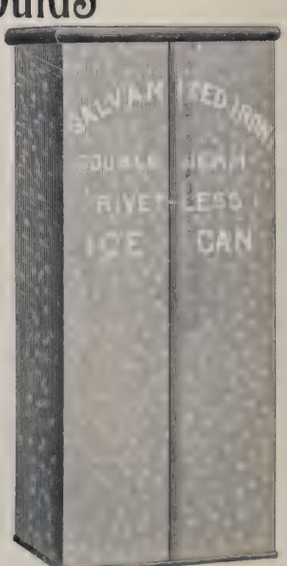
SPECIAL ATTENTION GIVEN TO REPAIRS AND REMODELING OF EXISTING ICE MACHINES.

ICE CAN DEPARTMENT

Galvanized Iron Ice Cans or Moulds

OF ANY SIZE, WEIGHT OR PATTERN.

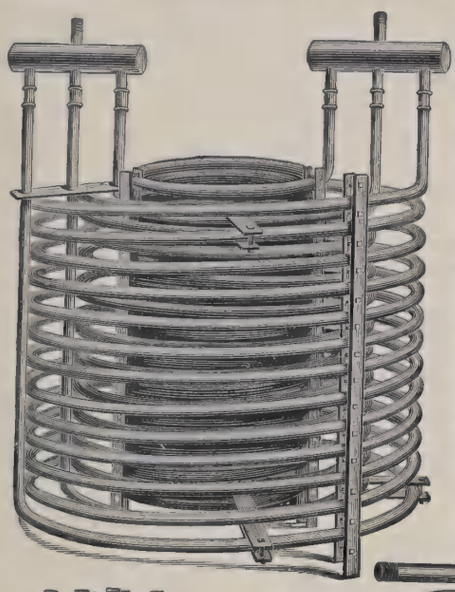
Our Double Seam, Rivetless Can has no rivets to catch the ice, which is freed from the can with less waste than any other style of Can in the market. . . . .



FLUSH BOTTOMS,
NO AIR POCKET TO FLOAT
CANS IN THE BRINE TANK.

EVERY CAN TESTED AND WARRANTED TIGHT.

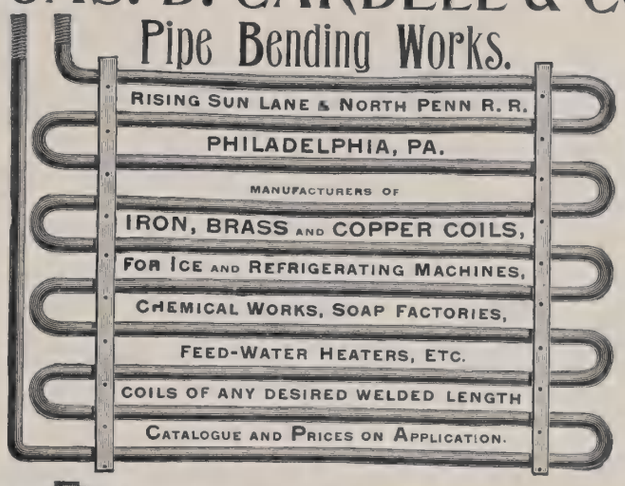
THE HARRISBURG PIPE BENDING CO. LIMITED.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

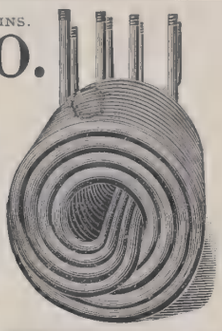
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

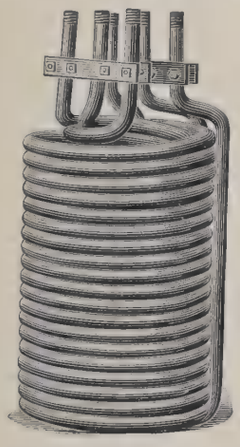
CATALOGUE AND PRICES ON APPLICATION.



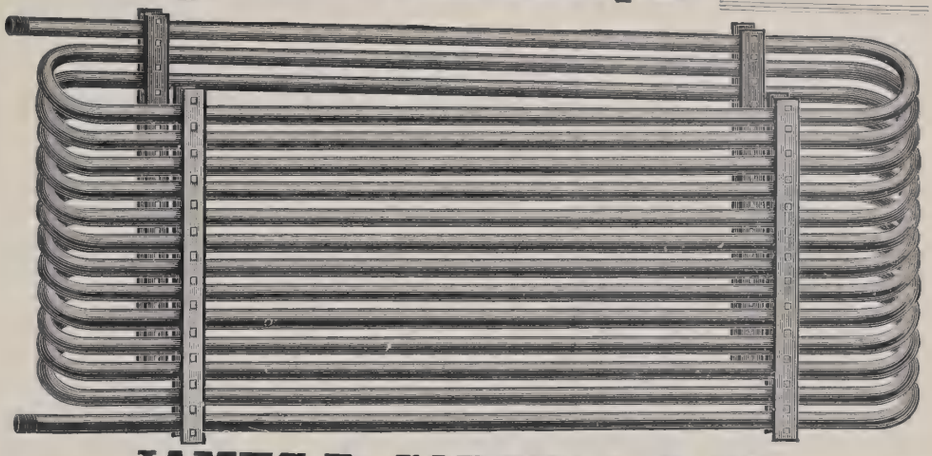
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.

READING IRON COMPANY

.....MANUFACTURERS OF.....

WROUGHT IRON PIPE, CHARCOAL IRON BOILER TUBES, AND OIL WELL TUBING AND CASING . . . . . .

SPECIAL Coiling and Ammonia Pipe FOR Ice AND Refrigerating Machines



Our Standard and Extra Heavy Pipe for bending and coiling purposes is being used largely by builders of Ice and Refrigerating Machines with unvarying success. We are also equipped for making Coils and Bends, Ammonia Valves and Fittings, Boilers, Tanks, Still and Absorbers.

Having had a large experience as builders of various types of Refrigerating Machinery, we are prepared to successfully construct this class of work.

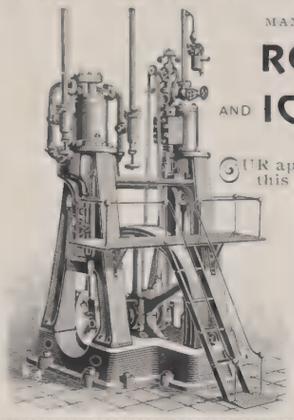
WE ARE NOW MANUFACTURING AMMONIA FITTINGS AND VALVES UP TO AND INCLUDING 6-INCH.

WE ALSO MAKE

IRON AND STEEL FORGINGS OF ALL DESCRIPTIONS.

AMERICAN ICE MACHINE CO.

J. F. MAYNARD, President.
G. A. WEISS, Vice-President.
T. J. CONNOR, Sec'y and Treas.

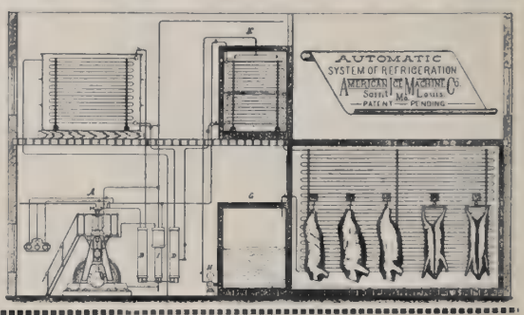


MANUFACTURERS OF .....

REFRIGERATING AND ICE MAKING MACHINES

FOR **ICE MANUFACTURERS, BREWERS, BUTCHERS, PACKERS, DAIRIES, ETC.**

OUR apparatus embodies the latest and best improvements in this class of machinery, and is durable and economical in operation. We are the only manufacturers of Refrigerating Apparatus that will produce and maintain a low and even temperature throughout the day and night, and needing no attention or power whatever during the night. The accompanying cut shows our Automatic Refrigerating System. Machines of one to one hundred tons capacity. Estimates and descriptive circulars cheerfully furnished.



OFFICE AND SHOPS,
320 and 322 SOUTH THIRD ST. **ST. LOUIS, MO.**

REFRIGERATING and ICE MAKING

SUCCESSFULLY DONE WITHOUT MACHINERY OR EXPERIENCED LABOR

FIRST COST LESS THAN ANY OTHER SYSTEM.
EXPENSES OF OPERATION ONE-FOURTH THAT OF OTHERS.
FOUR HOURS OF ATTENTION TO GIVE YOU 24 HOURS OF ICE MAKING OR REFRIGERATING.

THE AUTOMATIC REFRIGERATOR AND ICE MACHINE CO.

SEND FOR CIRCULAR. **LANCASTER, PA., U. S. A.**

FARRELL & REMPE,

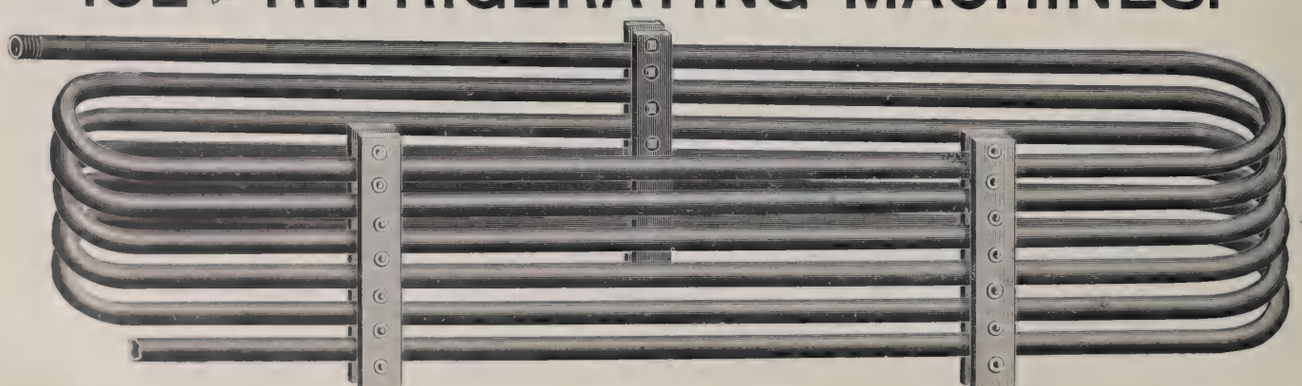
799, 801, 803 & 805 Ogden Avenue, corner Campbell Avenue, Chicago, Ill.

MANUFACTURERS OF

WROUGHT IRON COILS

—FOR—

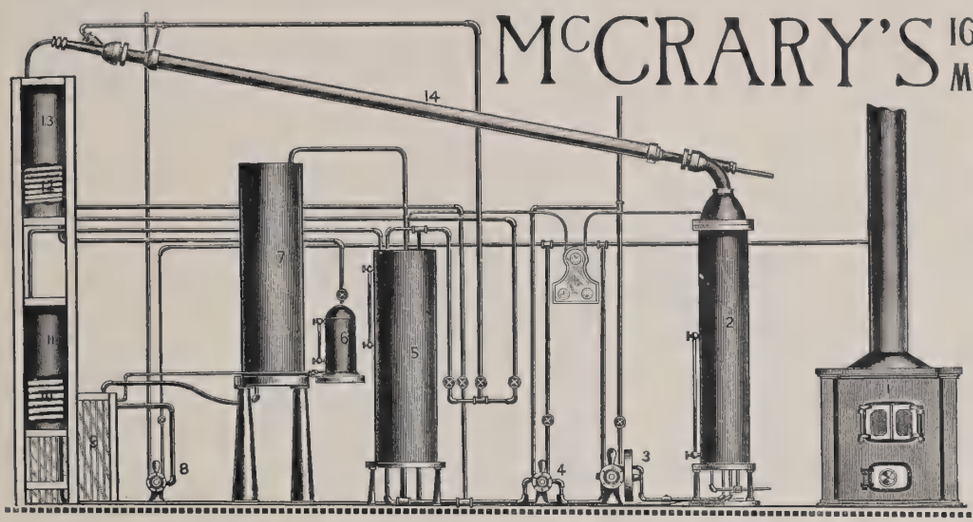
ICE AND REFRIGERATING MACHINES.



All Ammonia Coils made of the very finest quality of Pipe (in any desired continuous length) and Tested to 400 lbs. Air Pressure.
Coils of all Descriptions for Heaters, Soap Makers, Blast Furnaces, Etc.

PIPE BENDING OF ALL KINDS A SPECIALTY.

PRICES FURNISHED ON APPLICATION.
General Eastern Agents, DIENST & LINCK, 32 & 34 Ferry Street, NEW YORK.



McCRARY'S ICE AND REFRIGERATING MACHINE

Simplicity of construction and of operation, together with low price, will win for this machine a hearing on every occasion. Capacity from one to 100 tons. Send for descriptive circular, and state capacity wanted.

MANUFACTURED SOLELY BY

DeLoach Mill Manufacturing Co.

ATLANTA, GEORGIA.

Also manufacturers of the DeLoach Patent Saw Mill Machinery, Portable Corn Mills and Turbine Water Wheels.

SEND FOR CATALOGUE.

H. H. PHILPER,

BUILDER OF

REFRIGERATING AND ICE MACHINERY

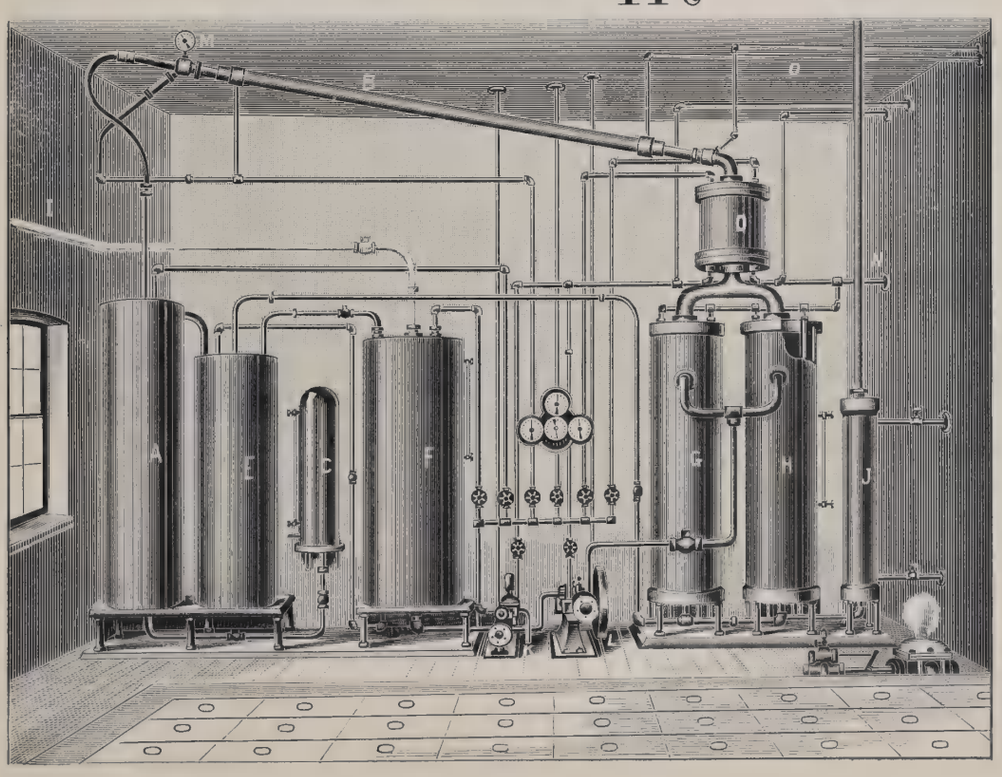
2620 S. Thirteenth Street,

ST. LOUIS, MO.

THE BURNS MANUFACTURING CO.

BUILDERS OF

IMPROVED ABSORPTION **Ice and Refrigerating Machines**



FOR ICE MAKING,
COLD STORAGE,
PACKING HOUSES,
CREAMERIES
AND BREWERIES.

Constructed on scientific principles, giving greatest possible results at minimum cost. Reliable, economical, easily handled and well constructed.

EVERY MACHINE GUARANTEED.

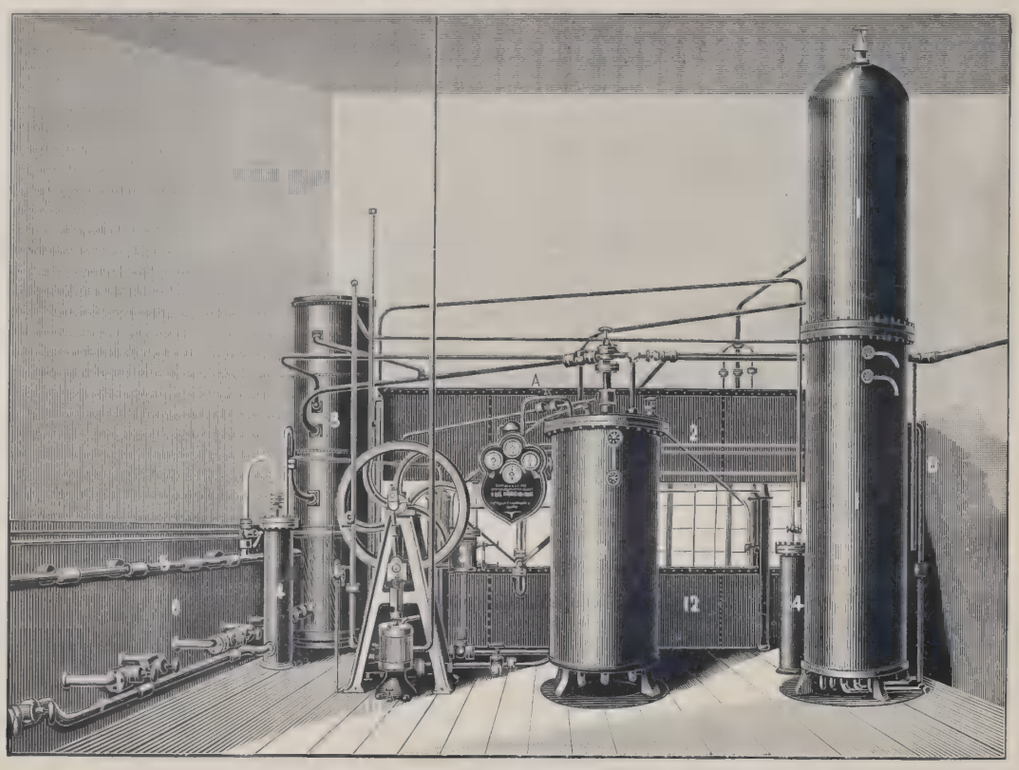
CORRESPONDENCE SOLICITED.

OFFICE:

45 Old Capitol Building,

ATLANTA, GA.

COLUMBUS IRON WORKS IMPROVED Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

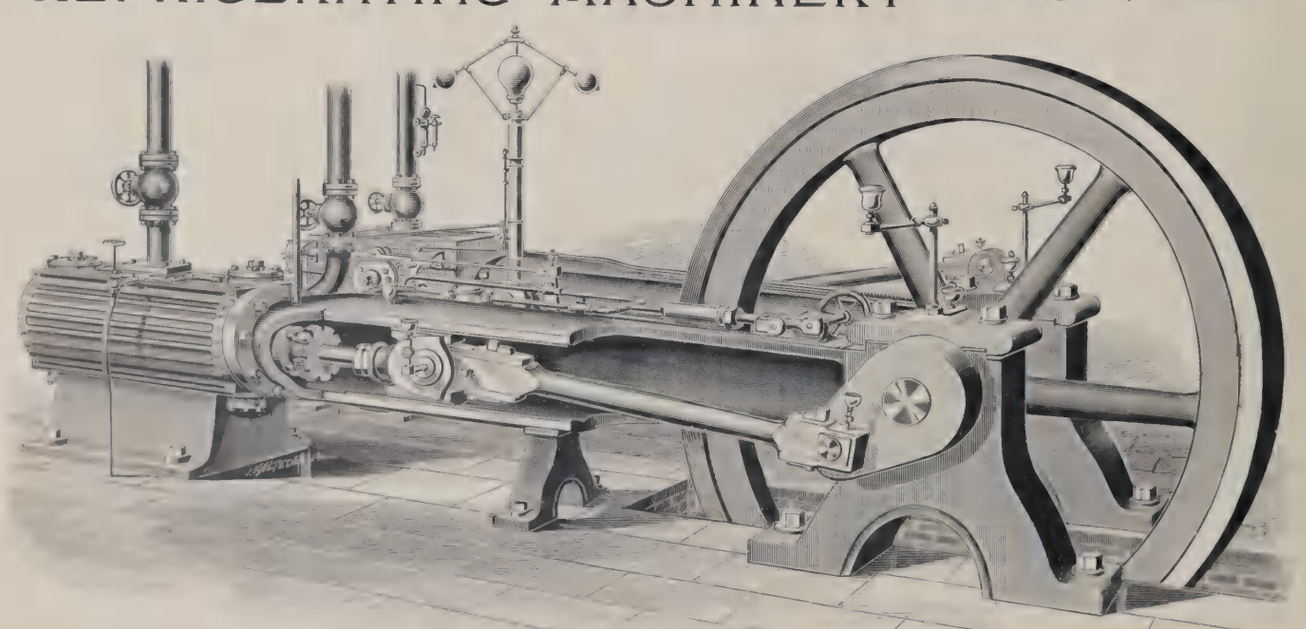
BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

REMINGTON MACHINE COMPANY

BUILDERS OF

ICE · MAKING AND REFRIGERATING · MACHINERY

Wilmington, Delaware.



HORIZONTAL COMPRESSORS,
WITH CORLISS AND SLIDE VALVE ENGINES,
HIGH PRESSURE AND COMPOUND.
From 10 to 50 Tons Capacity.

VERTICAL COMPRESSORS,
SINGLE AND DUPLEX,
DIRECT CONNECTED AND BELT POWER.
From 1 to 6 Tons Capacity.

SPECIAL AMMONIA VALVES AND FITTINGS, WROUGHT IRON TANK WORK.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

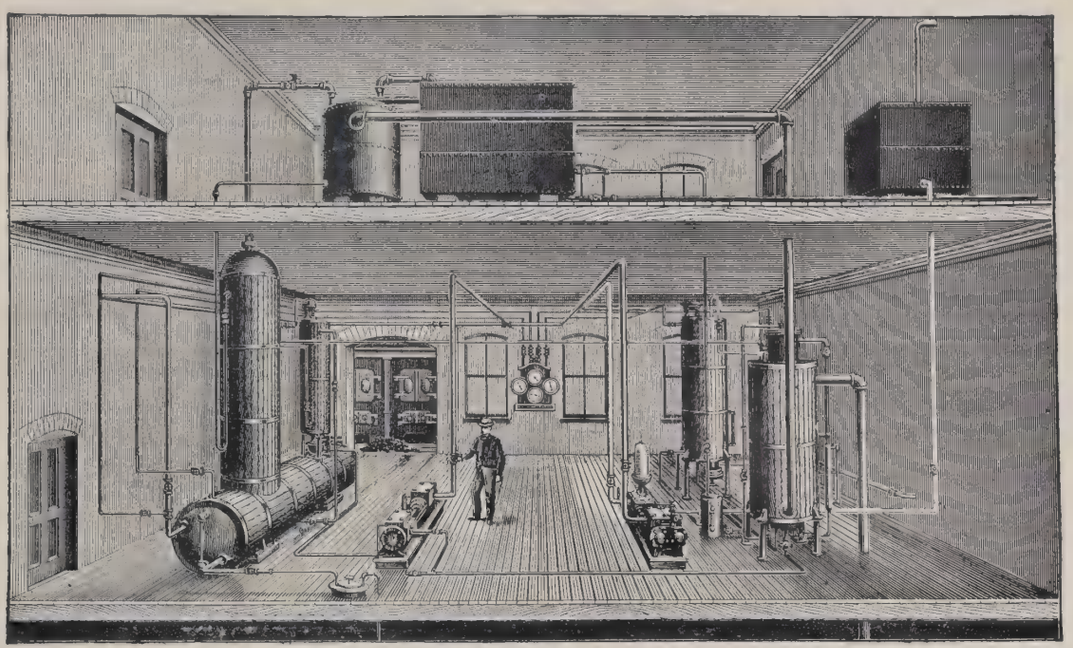
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



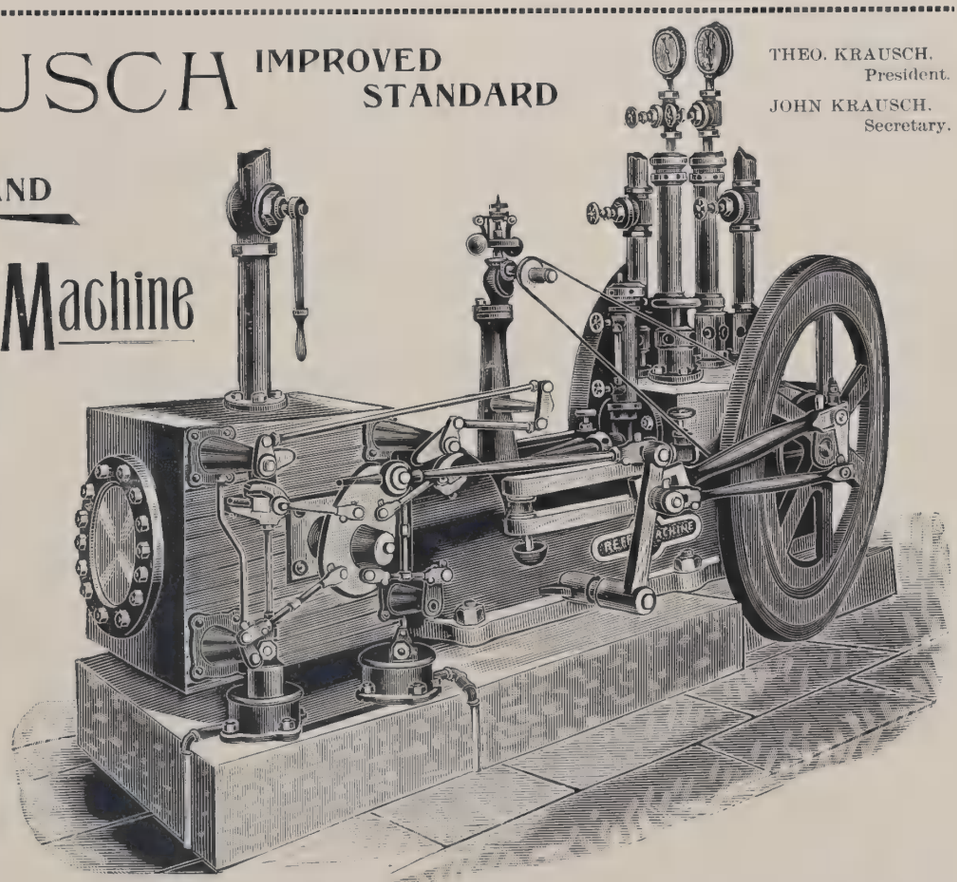
ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK 46 BRIDGE STREET, NEWARK, N J.

THE KRAUSCH IMPROVED STANDARD ICE AND Refrigeration Machine

THEO. KRAUSCH.
President.
JOHN KRAUSCH.
Secretary.



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops. Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

(6)

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK. OR THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING ..AUTOMATIC.. ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

ICE MACHINE PARTS OF ALL KINDS FOR SALE.

BOTH ABSORPTION AND COMPRESSION MACHINES REBUILT AND CAPACITY INCREASED.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

THE CASE REFRIGERATING MACHINE CO.

BUILDERS OF

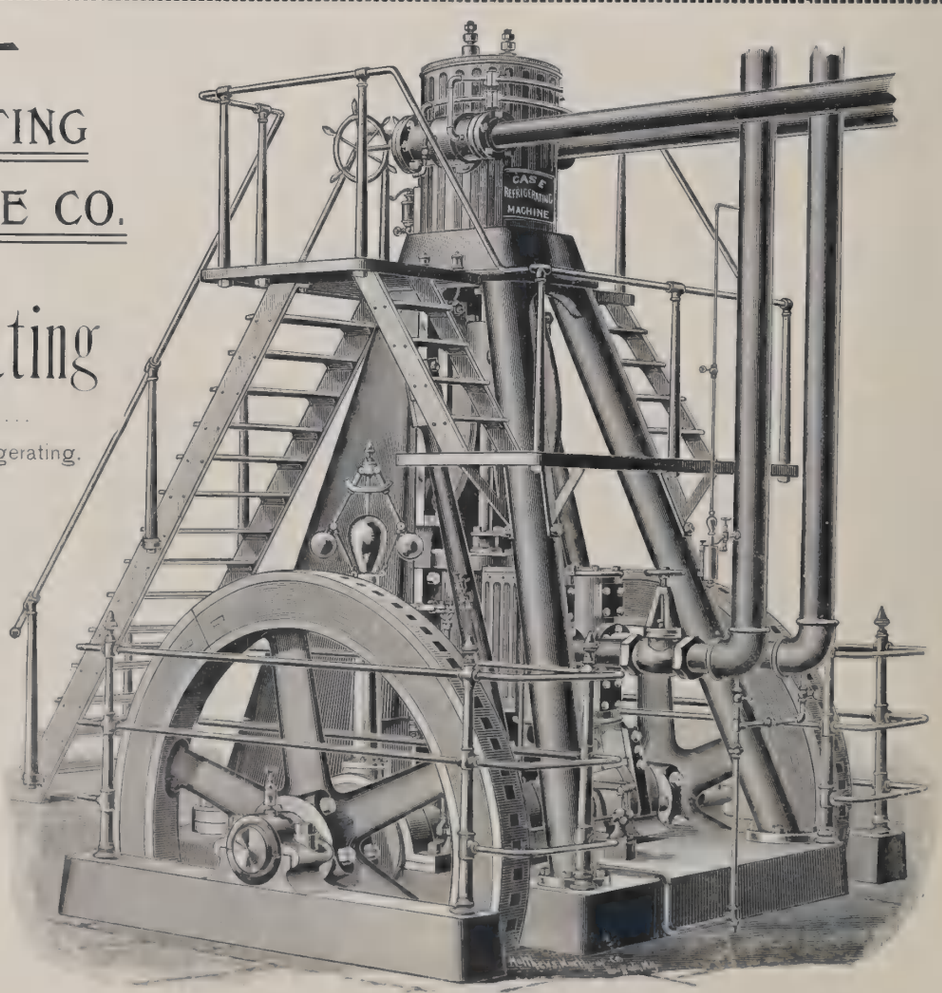
Ice & Refrigerating MACHINES

For Ice Making and Artificial Refrigerating.

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

We refer to the list of contracts taken by us since Oct. 1, 1891.

German-American Brg. Co., Buffalo, N. Y., one 65-ton machine.
Jos. Lauer Brg. Co., Binghamton, N. Y., two 20-ton machines.
Emlenton Producers Oil Co., Emlenton, Pa., one 20-ton machine.
International Brg. Co., Buffalo, N. Y., one 65-ton machine.
Woodside Brg. Co., Woodside, L. I., one 20-ton machine.
Wm. Ritter, Brewer, Chicopee, Mass., one 5-ton machine.
J. Schuessler Brg. Co., Buffalo, one 65-ton machine.
H. Luhr, Brewer, St. Mary's, Pa., one 5-ton machine.
The Thompson Packing Co., Buffalo, N. Y., one 20-ton refrigerating plant.
Jno. G. Grauer, Evergreen, L. I., one 40-ton refrigerating plant.
The Ft. Hamilton Brg. Co., Ft. Hamilton, L. I., one 40-ton refrigerating plant.



BUFFALO, N. Y.

JOHNSON,

McCARTHY

& JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

ICE & REFRIGERATING MACHINES . . . . . .

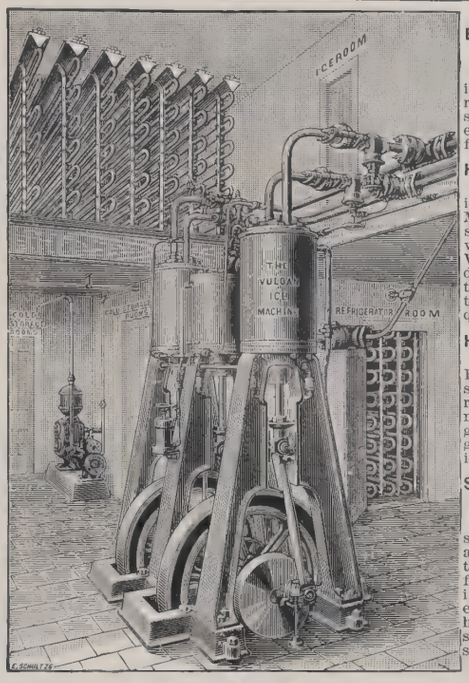
Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and . . . . .

Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect"

Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

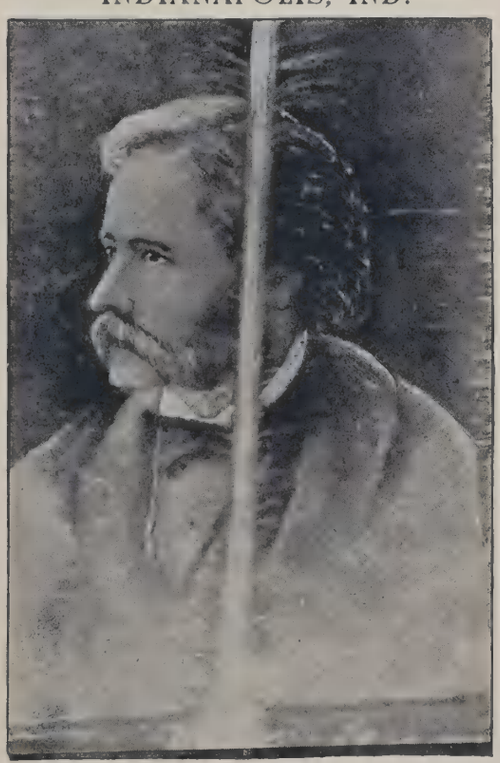
South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1887, has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

135-145 Fremont Street, SAN FRANCISCO, CAL.

Castle Ice Machinery Co.

INDIANAPOLIS, IND.



Photograph through fourteen inches Distilled Water Ice, by Seymour Ice Co. (Ind.)

MANUFACTURERS OF LATEST IMPROVED Absorption Ice Machines

GUARANTEED 500 LBS. TO 50 TONS PER 24 HOURS.

THE CRAFT REFRIGERATING MACHINE CO.

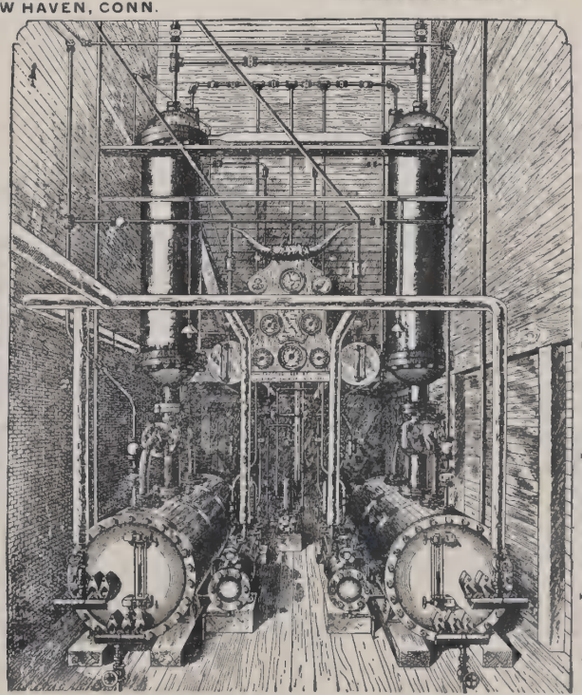
JAMES B. CRAFT, Prest.
F. L. BIGELOW, Vice-Prest.
GEORGE S. BARNUM, Sec. & Treas.

No. 15 Cortlandt Street, NEW YORK,

WORKS: NEW HAVEN, CONN.

....MANUFACTURERS OF....

Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.



Breweries, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

ICE AND REFRIGERATING MACHINES FOR ICE MAKING PLANTS.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

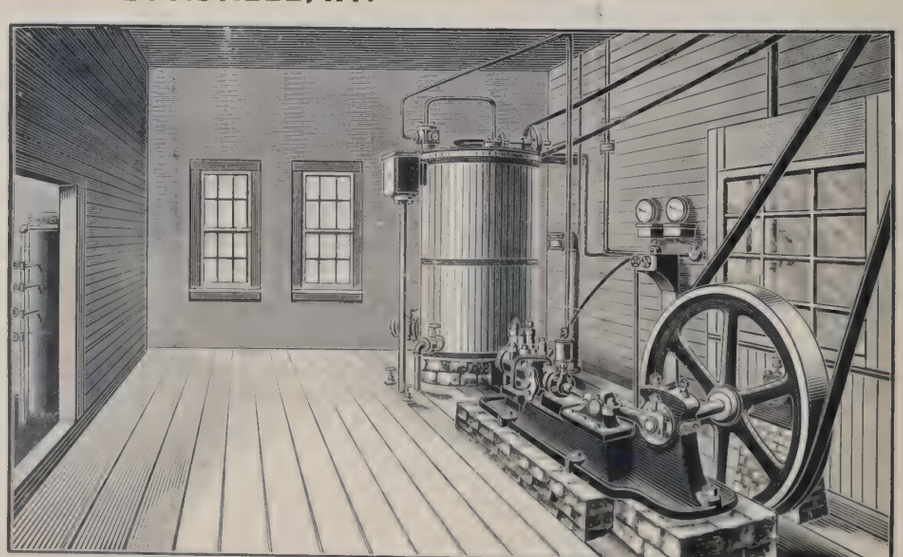
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



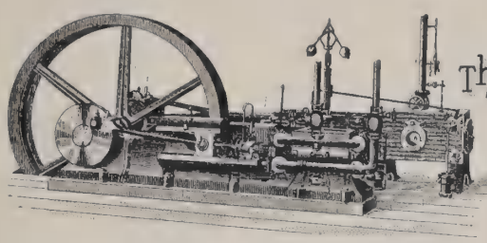
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,

Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

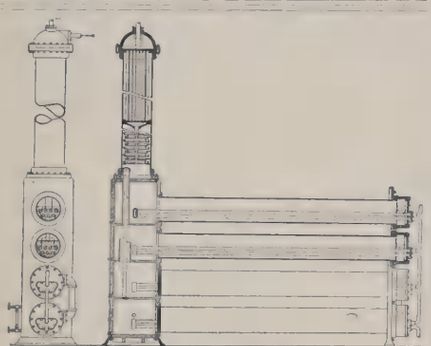
ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Ice Machines

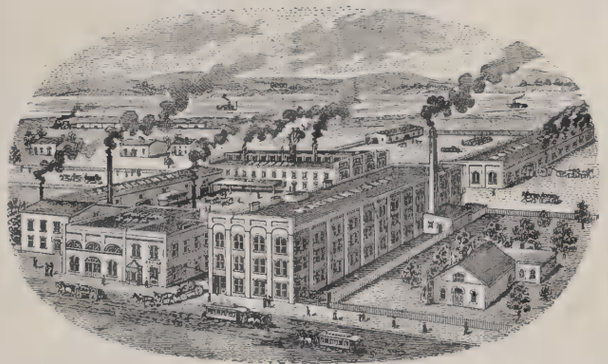


GENERATOR.

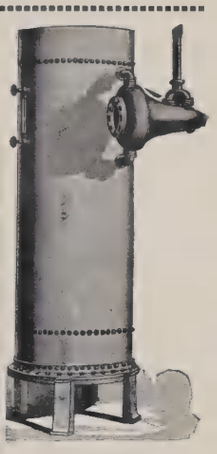
Patented Jan. 24, 1888; Sep. 23, 1890.

SULZER-VOGT MACHINE CO.

LOUISVILLE, KY., U. S. A.



IMPROVED ABSORPTION ICE MACHINES



ABSORBER, With Regulating Valve.

The American Ice Machine Company

SOLE OWNERS OF THE

KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction. Every part is simple and complete,** is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

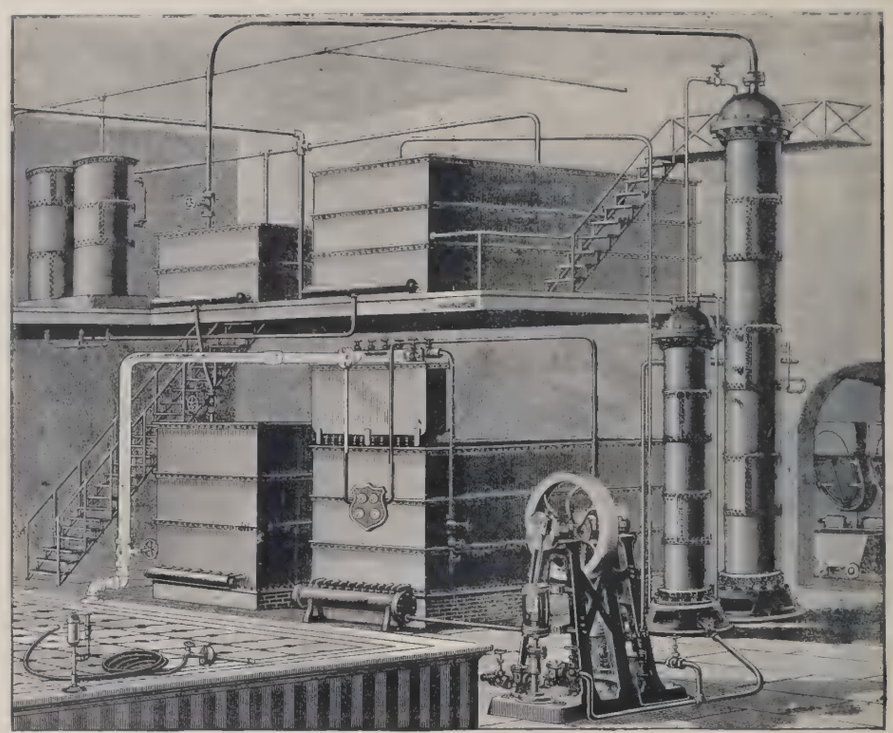
5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

Blymyer Ice Machine Company

CINCINNATI
OHIO . . . . .



THE ***ABSORPTION MACHINE*** made by the Blymyer Ice Machine Co. is superior to any compression machine, either for refrigerating or ice making. These machines are ***radically different*** from all other absorption machines, and are in every way superior to them.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. 2d Order	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co.	Sheffield, Ala.
1	5 "	Decatur Ice Co.	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	3 "	Denton Ice Co.	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston.	West Point, Miss.
1	3 "	DeCoppet Ice Co.	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co	Huntington, W.Va.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co	Wheeling, W.Va.
1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld.Stor. & Ice Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co. (2d Order	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
*1	15 Ton.	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co. (4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
**1	8 "	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
*1	30 "	The People's Ice Co.	Birmingham, Ala.
*1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order	Pueblo, Col.
*1	60 "	Colorado Ice and Storage Co.	Denver, Col.
*1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La
*1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
*1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
*1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

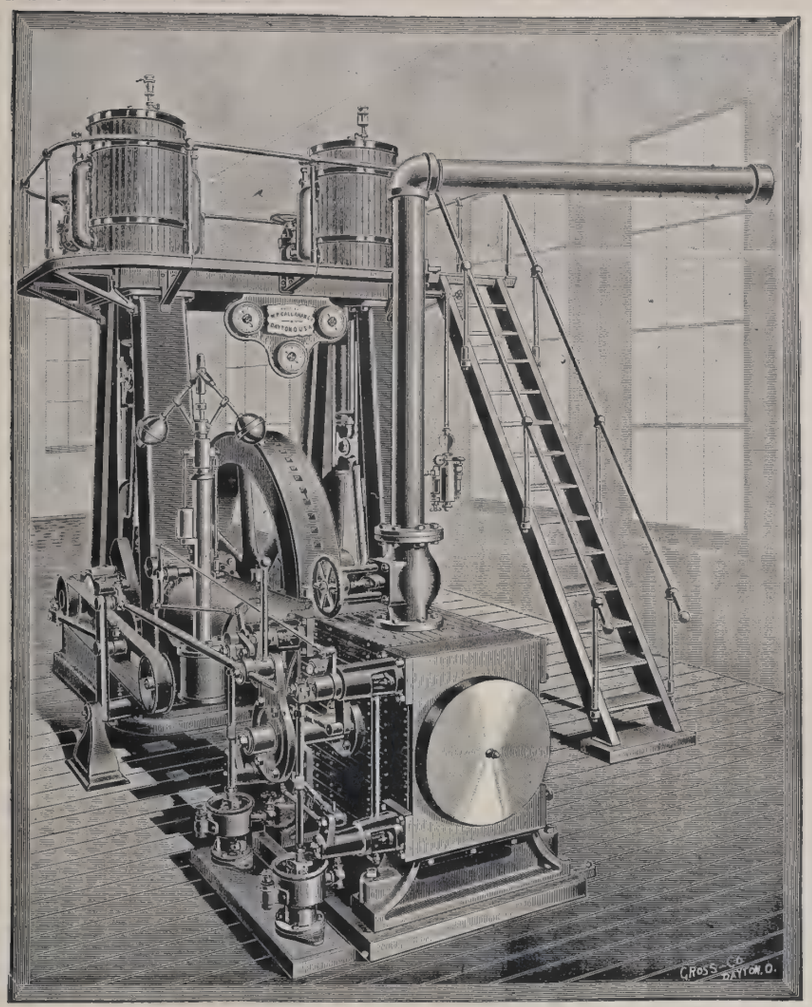
* These machines were erected in 1890.
** These machines were erected in season 1891.



BLYMYER REFRIGERATING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	Address.
	Ton.		
2	50	Louisiana Brewing Co.	New Orleans.
1	40	Toledo Br'g & Malt'g Co.,	Toledo.
1	40	Hudepohl & Kotte (Brew'y)	Cincinnati.
1	50	Savannah Brewing Co.	Savannah.
1	25	Schantz & Schwind (Br'y	Dayton.
1	15	John Smith's Sons (Brew'y)	Youngstown.
1	12	Christ Diehl (Brewery)	Defiance.
1	12	Genessee Oil Works.	Buffalo.
1	12	S. Davis, Jr., & Co. (Pack'rs)	Cincinnati.
1	50	Occidental Packing & Provision Co.	Lincoln.
1	15	Thos. McFadden, Jr. (Cd. St.)	Pittsburgh.
1	15	Grocers' Supply Co. (Cd. St.)	Pittsburgh.
*1	40	Adolph Coors (Golden Br'y	Golden.
*1	20	F. Conrad (Brewery)	Anaheim.
*1	25	The Sachs-Prudens Ale Co.	Dayton.

* These machines were erected in 1890.



CUT OF . . . . . .
FIFTY TON REFRIGERATING
AND . . . . . .
THIRTY TON ICE MAKING
MACHINE, BUILT BY

W. P. CALLAHAN & CO.

BUILDERS OF

Ice Making AND Refrigerating Machinery

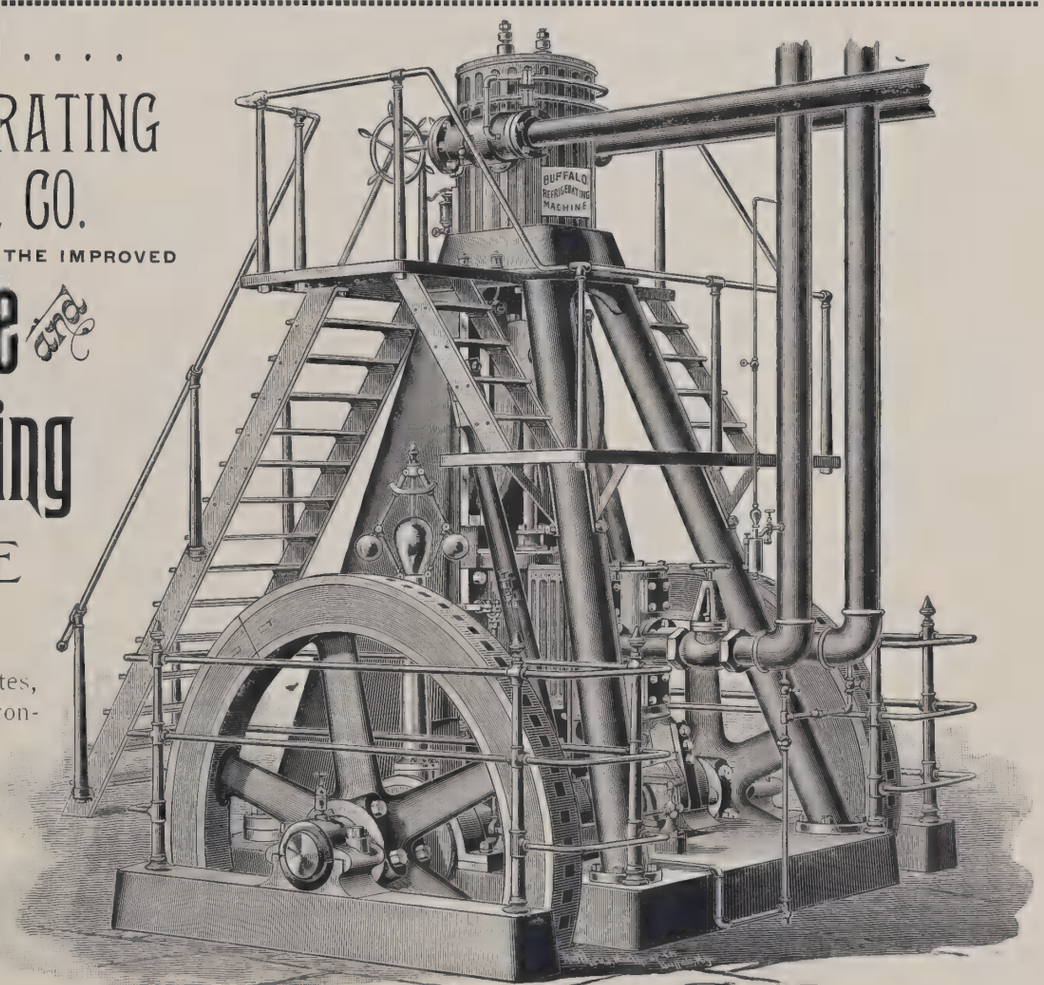
UNDER M. DENNEDY'S PATENT.

DAYTON, OHIO, U. S. A.

BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE



Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

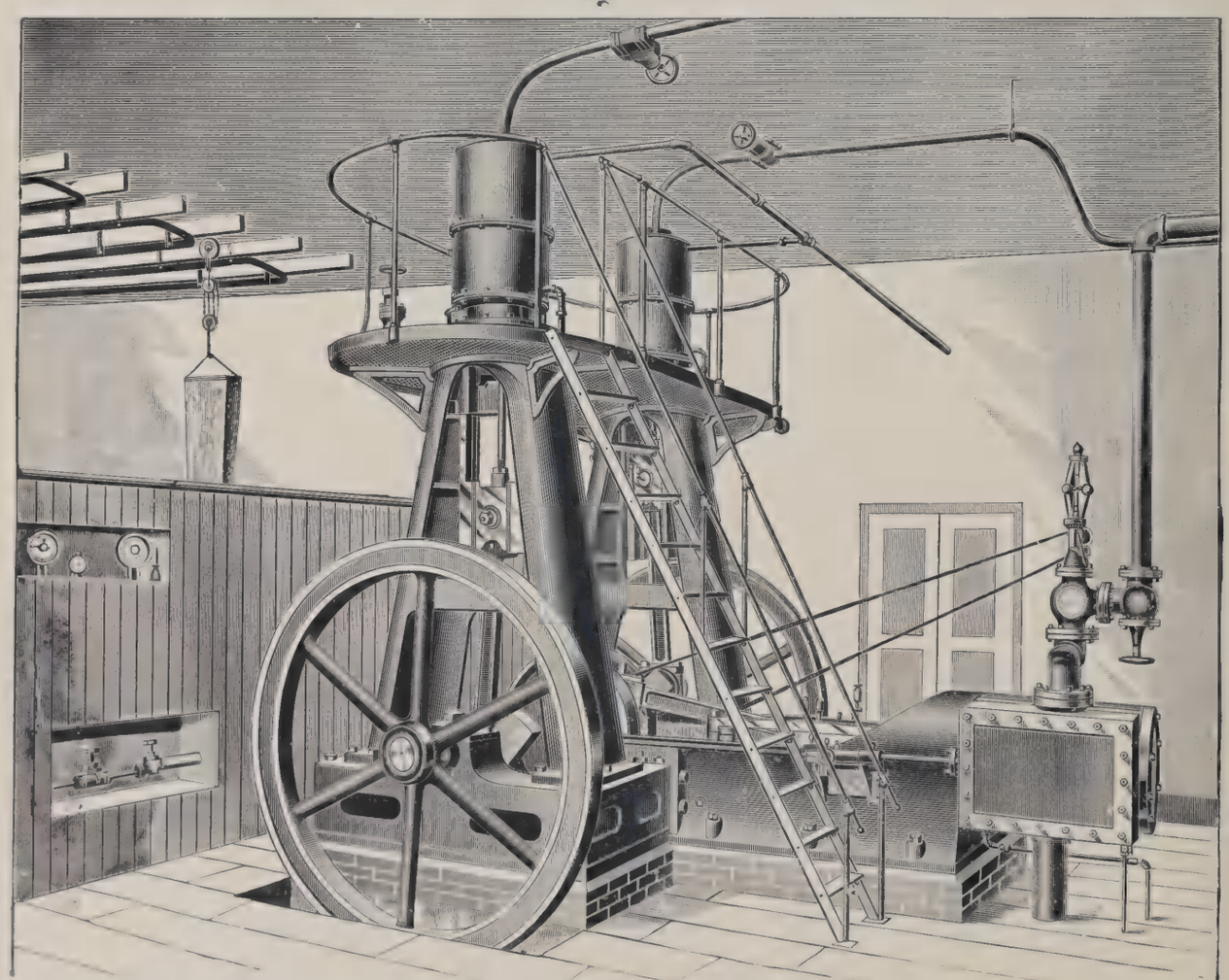
ICE MAKING MACHINERY

E. C. HILLYER & CO.

MANUFACTURERS OF

Improved Ice Making Machinery AND Refrigerating Apparatus

UNDER THE JOHNSON PATENTS.



VESSEL AND STEAMSHIP PLANTS

THE SIMPLEST AND MOST EFFECTIVE ICE MAKING MACHINERY ON THE MARKET

All working parts made to gauge and template, so as to be readily duplicated. Correspondence solicited. Testimonials from parties using our machines on application. We build our own machinery, and therefore can guarantee everything fully. Our machine will in every case make the amount of ice guaranteed. Send for our pamphlet: "HOW TO MAKE AN ICE FACTORY PAY."

WE BELIEVE OURS TO BE THE ONLY SYSTEM WHERE ALL THE APPARATUS IS ON ONE FLOOR.

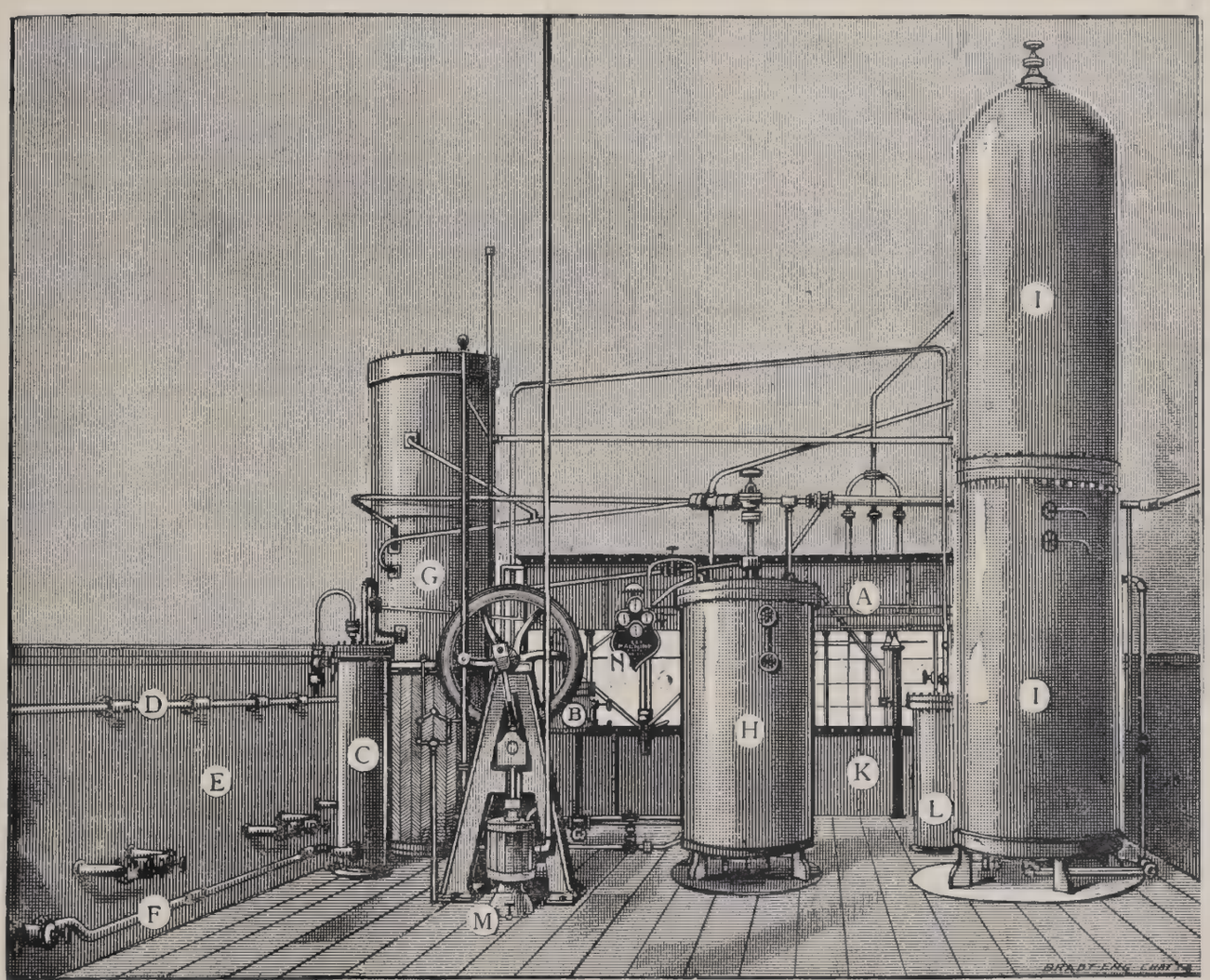
Office and Works, **NEWPORT NEWS, VA.**

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

· · · The Latest Improved Absorption · · ·

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

Pennsylvania Iron Works Company,

GENERAL OFFICES AND WORKS, 50th ST. AND MERION AVE.,

PHILADELPHIA.

NEW YORK OFFICES,
9 & 11 WALL ST.

ICE MAKING AND REFRIGERATION MACHINERY

COMPRESSION OR ABSORPTION SYSTEMS.

BUILDERS OF THE CELEBRATED "BOYLE" COMPRESSION MACHINES

FROM ONE TO ONE HUNDRED TONS CAPACITY, SINGLE MACHINES.

BUILDERS OF THE.....

Rankin Absorption Machines

OF ANY CAPACITY.

EVERY MACHINE ERECTED OF BOTH SYSTEMS HAS GIVEN ENTIRE SATISFACTION IN ALL RESPECTS.

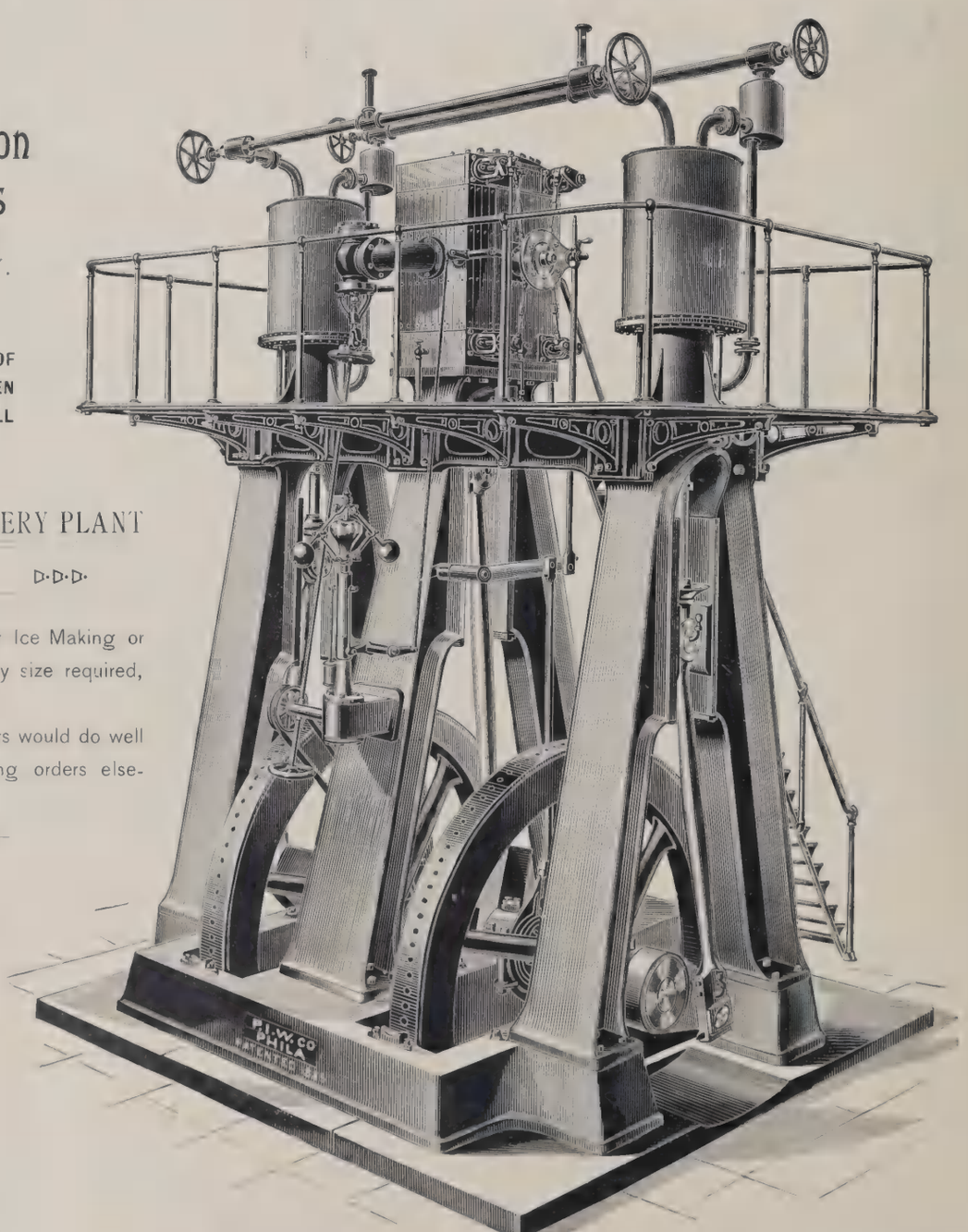
WE GUARANTEE EVERY PLANT THAT WE ERECT. D·D·D·

Plans and Estimates for Ice Making or Refrigeration Plants, of any size required, furnished on application.

Contemplating purchasers would do well to consult us before placing orders elsewhere.

CATALOGUES AND REFERENCES

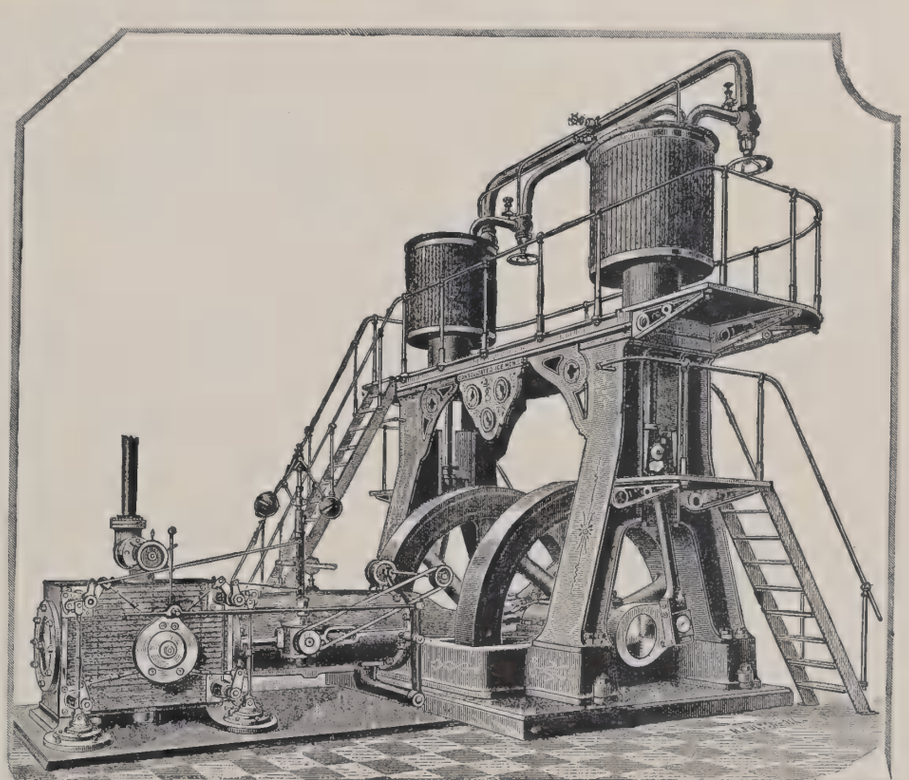
CAN BE HAD ON REQUEST FOR SAME



THE ABOVE CUT REPRESENTS THE IMPROVED "BOYLE" MACHINE FOR 50 TONS DUTY.



CONSOLIDATED ICE MACHINES



WE have bought from the assignee of the Consolidated Ice Machine Co. all the machinery, patterns, drawings, tools and good will of the old company, including all patents owned by them, and under which they built the original Consolidated machines. We will continue to manufacture these machines of every size and style for both ice making and refrigerating, and will put in either brine circulation or direct expansion to suit purchasers. We are also prepared to furnish on short notice any detail of them, and all kinds of steel ammonia fittings or valves used on a Consolidated plant. We have learned that certain parties in New York City claim that they are manufacturing the Consolidated Ice Machine, and control the same. This statement is a brazen falsehood, without foundation in fact. All the original patterns and drawings are in our possession and controlled by us, and no other firm has access to them or can furnish one of them, or a duplicate part, without first purchasing the same from us. We guarantee to all persons buying a Consolidated machine of our make protection against any and all claims made for damages by persons representing that they hold patents on any part of them, as all such claims are known to be false and fraudulent.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF **ICE**

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

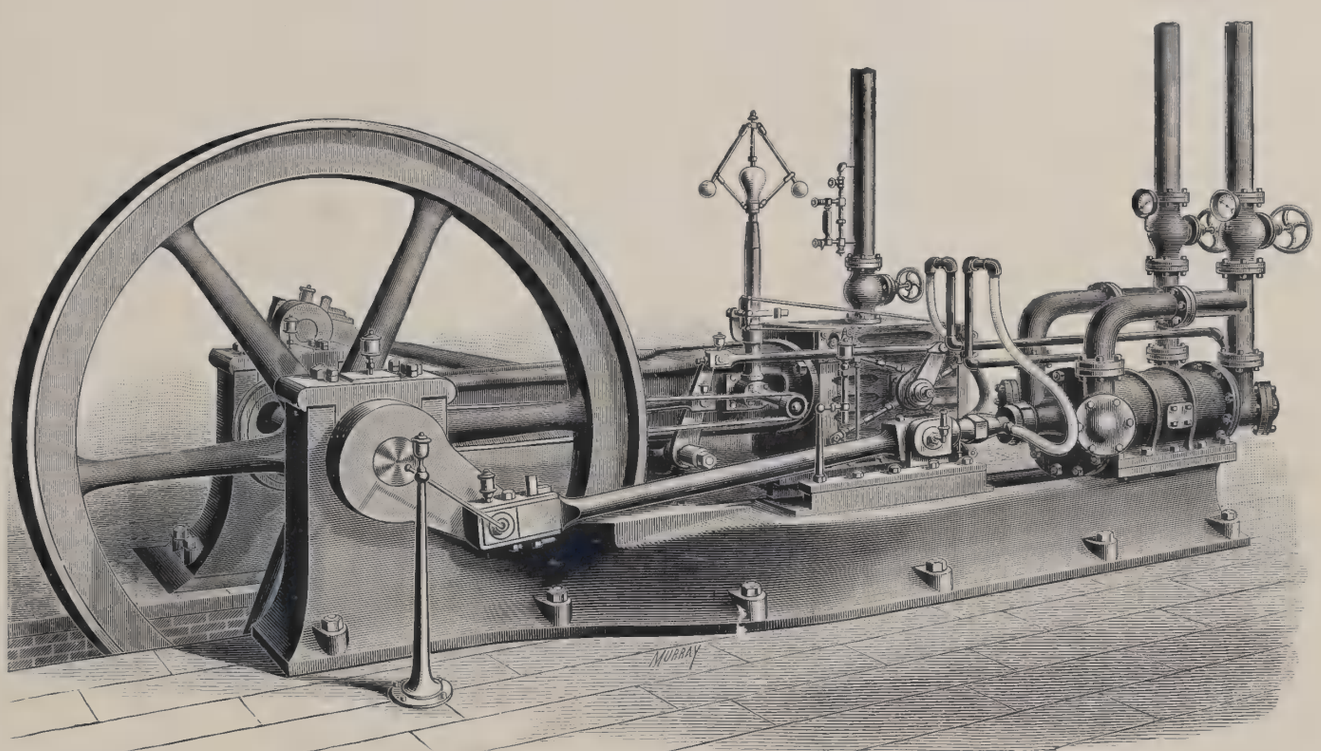
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

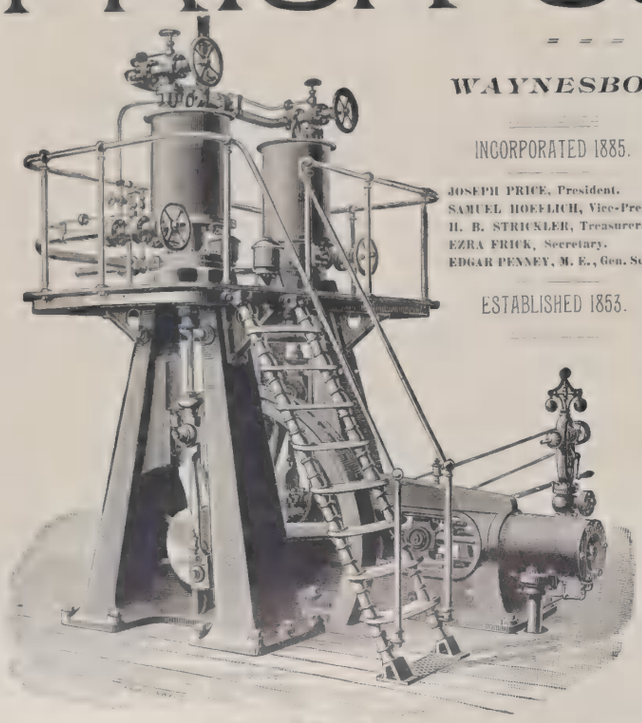
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making AND Refrigerating Machines.

SEND FOR OUR NEW CATALOGUE, 1890.

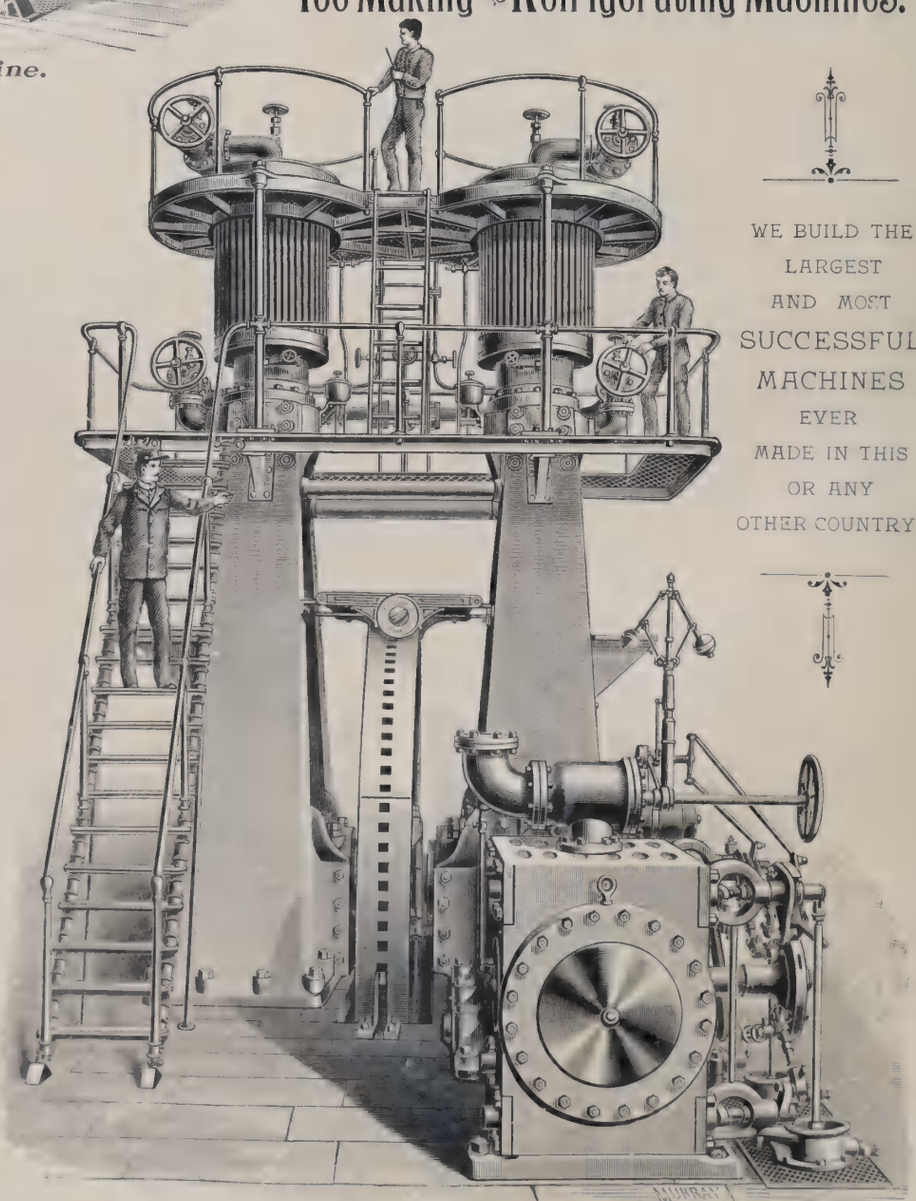
A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas	150
Emil Winters, Pittsburgh, Pa	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb	150
Calumet Canning Co., Hammond, Ind.	32
West Chester C'd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & C'd. Stor. Co., Owsb'o, Ky	20
W. S. Lurton, Jacksonville, Ill.	15
Pulaski Ice Co., Pula-ki, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

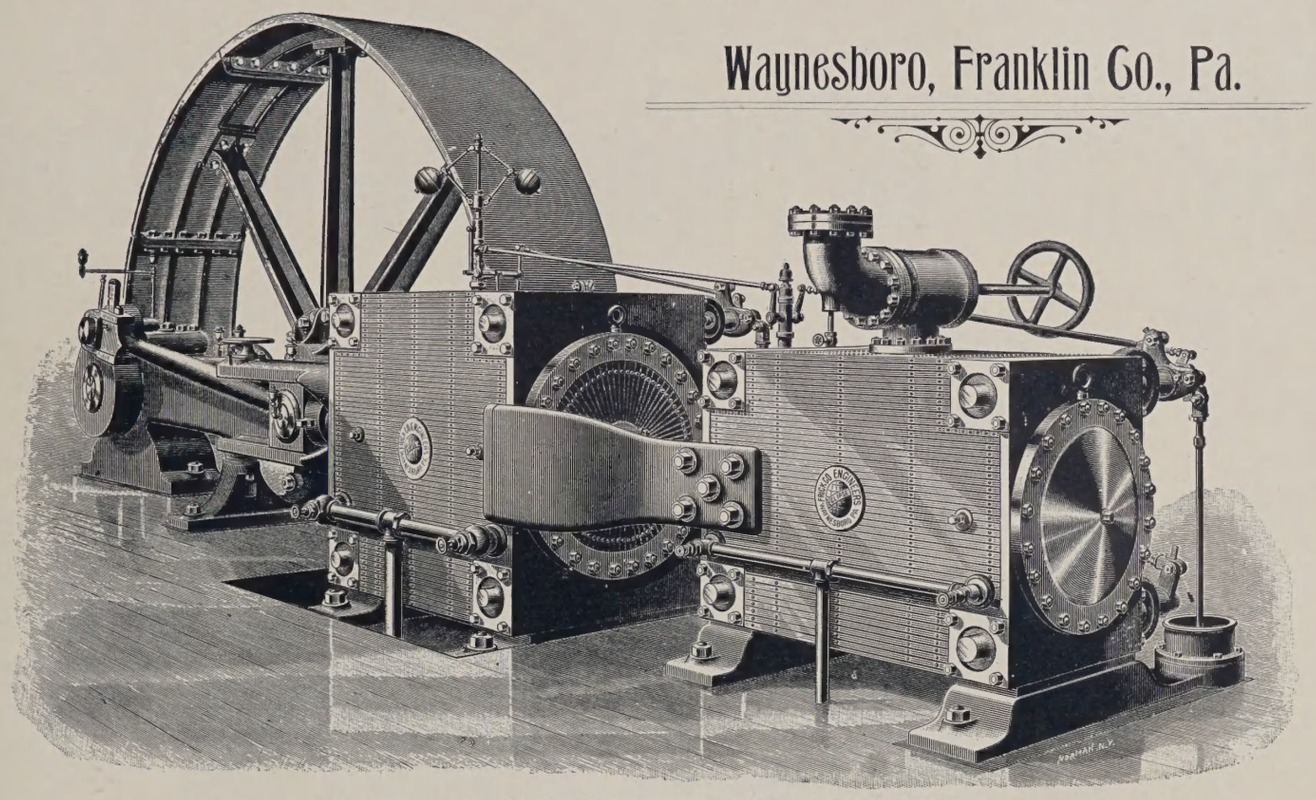
WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.



150-Ton Machine. Weight, 193,250 Pounds.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

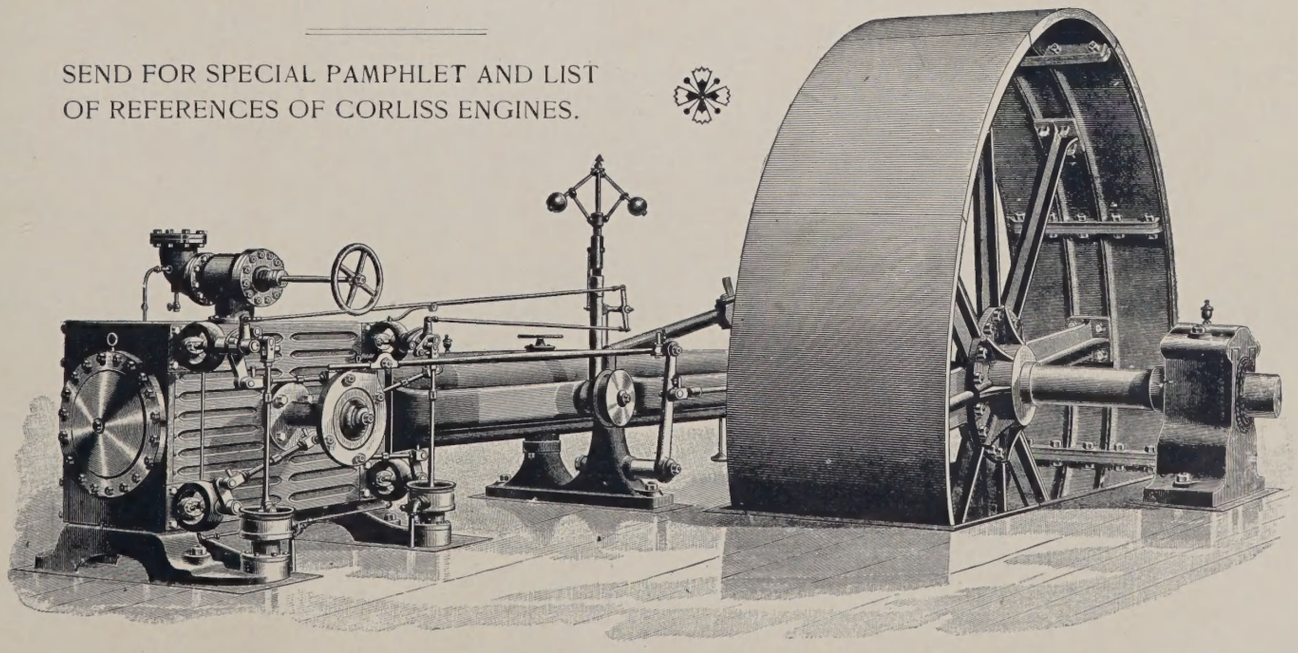
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000-horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION.....

PITTSBURGH, PA.